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NOVEMBER, NINETEEN HUNDRED ELEVEN

Contracting Practice.

By DeWitt V. Moore, Mem. Am. Soc. Eng. Contr., Indianapolis, Ind.

LABOR COST DISTRIBUTION, PAY ROLL SYSTEM.

IN beginning the consideration of the construction period reference must be made at once to the "Itemized Cost Estimate" (August number) and a condensed list made of those main divisions of work which should be carried separately on the regular time sheet report.

The time sheet prepared is a form which is the result of many years' experience and which is so arranged that it may be used for any character of work, carried either as weekly or daily reports to the office or to the contractor.

The instructions for the use of time sheet appear on the right hand side of the reverse side of sheet but as in the reproduction of Plate XII the type is very much reduced the instructions are given following:

INSTRUCTIONS FOR USE OF TIME SHEETS.

"It is intended that this sheet shall be used for all jobs, whether timekeeper makes report to pay-roll clerk daily, weekly, or monthly, and is to be used also for making summary reports. In using time sheet side, always place date at head of column and when making out summary sheet, place daily dates in the name column. In using the distribution side, the column marked "Timekeeper's check column" must have dates placed at the head corresponding to the time sheet side, and each column represents one day, the distribution being taken four times per day and marked inside of the four little squares, using distribution letter. However, for daily sheets, each vertical column represents one hour, and separation of time must be checked to the hour. Distribution columns will be headed by rubber stamp for each job and each man's time must be distributed under the proper columns and the totals reduced to dollars and shown at foot of sheet, except that for summary sheets, total for each day will show opposite same. Timekeepers must keep careful record of cars received, expense and cement and fill out form on opposite page. Timekeepers and engineers will co-operate to insure that summary sheets are correct as to time distribution and amount of work done. Daily time sheets must be turned in to the office at the close of each day, weekly time sheets each Thursday evening, and bi-monthly or monthly sheets will be separated and turned in at least once each week. No change of rate of pay will be allowed between pay-roll periods.

"No deviation from these instructions will be allowed on any job."

It will be noted that the distribution columns are headed by letters. No two jobs may have the same letter for the same kind of work, but for the particular job each letter stands for a classification of work and the cost distribution book is likewise headed so that there can be no error.

The actual size of this time sheet is 8¼ inches high by 10 inches wide and provides for 25 names and 13 distributions. In use the time sheet should be placed in a cover as shown in Plate XII, which holds the sheet by the corners in the same manner as the ordinary desk pad. The covers can be placed in the side pocket of the coat, being 5¼ inches by 8½ inches. One corner of the sheet is left out of its pocket in Plate XII.

Plate X shows the front or time-keeping side of the time sheet arranged for daily reports. Plate XI shows the same form of time sheet as used for weekly reports. The top and bottom of these sheets are shown, the number of lines between being sufficient to fill the space between, which can be estimated from Plate XII.

Plate XII shows the reverse side of time sheet and special notice is called to the right hand side where a continuous record is obtained of the job from beginning until completion.

In the beginning of a job under this system the men are all given numbers beginning with the superintendent as No. 1.

TIME SHEET, JOB NO. 20 FROM _____ TO 10/13/11

For Instructions See Reverse Side

NO	NAME (See Instructions)	DATES	TOTAL HOURS	RATE	TOTAL AMOUNT $	C
	BROUGHT FORWARD					
8	James Brown		10	25	2	50
9	Pete Mike		6	20	1	70
	TOTALS				3	70

SIGNED Henry Jones.

TIME KEEPERS CHECK COLUMN — See Instructions — Contract No. 20

DATES OR HOURS: 6 A.M. 7 8 9 10 11 12 1 2 3 4 5 6 7 P.M.

	DISTRIBUTIONS (See Instructions) A	B	C	D	E	F	G	H	I	J	K	L	M
	Excavation	Filling	Concrete	Forms	Finish	Brick	Stone	Specials					
TOTAL HOURS	5		11										
TOTAL NEAREST DOLLAR	1		2										
TOTAL CEMENT USED (BAGS)													

X. CONTRACTING PRACTICE. Time Sheet. Daily Report Form.

TIME SHEET, JOB NO. 21 FROM 10/7 TO 10/13/11

For Instructions See Reverse Side

NO.	NAME (See Instructions)	DATES 10/8 Sun.	10/9 Mon.	10/10 Tue.	10/11 Wed.	10/12 Thu.	10/13 Fri.	10/7 Sat.	TOTAL HOURS	RATE	TOTAL AMOUNT $	C
	BROUGHT FORWARD											
72	Richard Roe		10	10	3				23	.20	4	60
73	John Doe		10	10	10	10	10	10	60	.20	12	00
	TOTALS											

SIGNED John Smith

TIME KEEPERS CHECK COLUMN — See Instructions — Contract No. 21

DATES OR HOURS: Sun. Mon. Tue. Wed. Thu. Fri. Sat.

	DISTRIBUTIONS (See Instructions) A	B	C	D	E	F	G	H	I	J	K	L	M
	Excavation	Filling	Concrete	Forms	R.-Concrete	Forms & C.	R.-Steel	Cem. Finish	Brick	Extras			
TOTAL HOURS	15	15	53										
TOTAL NEAREST DOLLAR	3	3	11										
TOTAL CEMENT USED (BAGS)			450										

XI. CONTRACTING PRACTICE. Time Sheet, Weekly Report Form.

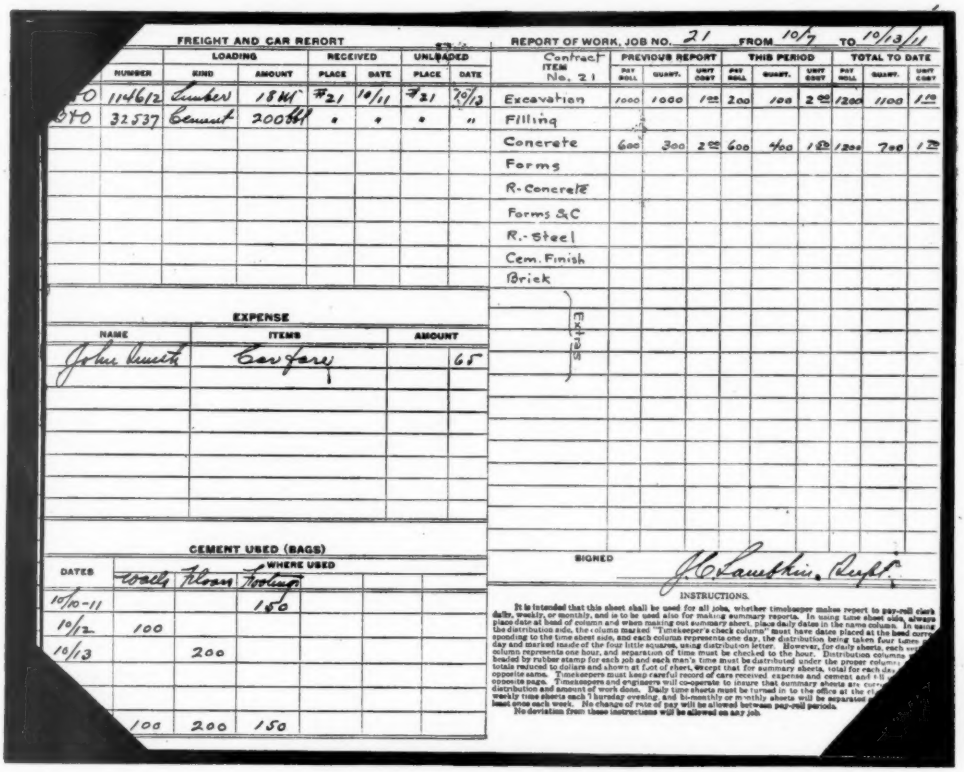
Identification cards are issued, as shown by Plate XIII. These cards are retained until the end of the pay roll period, generally one week, and surrendered in exchange for the pay roll envelope containing wages. Each week new cards should be issued of different colors so in rotation that one color will not be used again for at least one month. This scheme obviates the disadvantages of the brass check sys-

tem while fulfilling the same purpose. The cards can be expected to remain in good condition for a reasonable period, they serve the purpose of absolute identification, and are receipts beyond question when in the hands of the paymaster.

By using the different colors, there can be no duplication or errors due to the numbers assigned to the men. For instance, No. 72 on the week yellow cards are used may not be the same as No. 72 the next week when blue cards are issued.

prepares his pay roll, Plate XIV. A pay roll should be prepared day by day, as one hour's work per day will mean seven hours or a whole day at the end of the week and such a procrastination may result in a failure to complete the pay roll on time or at least to increase the chance for many careless, otherwise unnecessary, errors.

The pay roll envelopes are then prepared, using the pay roll as a basis and these envelopes of form Plate XV are



XII. CONTRACTING PRACTICE.
Time Sheet—Reverse Side. Special Reports and Summary of Work. Pocket Case for Carrying Sheets.

This arrangement allows that the older men in life of employment may be moved up from time to time so that the higher numbers are indicative of new untried men, thereby bunching the steady employees in the tabulation on the pay roll. The colors to be used are red, blue, yellow and green. The men generally wear the cards in their hat bands. The simplification of work to the timekeeper and paymaster is beyond computation.

The time sheets are filled out from day to day and handed to the paymaster, who

made in colors the same as the identification cards, so that a man who calls for his money several days or weeks after pay day can not be confused with any other man of possibly the same number or name working during a different pay roll period.

During the interval of pay roll periods it is necessary to discharge many men, which is brought into harmony with the general system by the use of Discharge Blanks, Plate XVI.

Let us trace regular and floating employees through their introduction to this

[redacted] COMPANY

IDENTIFICATION TICKET

Name Richard Roe

Contract No. 21 Roll No. 72

Pay Roll Ending Oct. 13th 1911

Hours Rate Amount

Rec'd Payment Richard Roe

Countersigned John Smith Timekeeper

XIII. CONTRACTING PRACTICE. Identification Card.

system using both daily and weekly reports.

We will suppose we have two jobs under construction, one on a basis of daily reports and one weekly. In both cases all men employed have been assigned numbers and cards as per Plate XIII.

The hours, rate and amount are not filled out on card unless for a particular reason it is desired to obtain a definite receipt.

The time sheets, Plates X and XI, show these men and time made by them and the character of work upon which they were placed.

Note by Plate X that James Brown, No. 8, worked 10 hours from 7 a. m. until 12 m., and from 12:30 until 5:30 p. m., making 10 hours, of which 5 was on excavation and 5 on concrete.

Pete Mike, No. 9, came on at 11 a. m., and worked one hour until 12 m. on concrete, then began at 12:30 p. m., worked until 5:30, making 6 hours. The time spacing at head of timekeeper's column being arranged for each division for one hour, the top half is for the hour and the bottom half for the half hour. It is not necessary to mark distribution letter in each column as it is understood the man continues on the same work until by a distribution letter change he is placed on other work at the closest hour or half hour.

Assuming at the same time we have job No. 21 running on a basis of weekly reports, we see Richard Roe, No. 72 (Identification Card, Plate XIII), worked Monday to Wednesday, being discharged on the latter day, having made 23

[redacted] Co.

PAY ROLL

(Semi-Monthly Form)

CONTRACT NO. 21) [redacted] AT Whitefield

Laurkin) GANG NO. 1) AT #21

FROM 10/7 TO 10/13

No.	NAMES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total Hours	Rate	Total Amt. Pay Roll	DEDUCTIONS: Co. Board	Co. Supplies: Item	Co. Supplies: Amount	Cash Advances: In lieu of	Cash Advances: Amount	Miscellaneous: In lieu of	Miscellaneous: Item	Miscellaneous: Amount	Net Amount Due	How, When and to Whom Paid	No.
71																																															1
72	Richard Roe								10	10	3																						23	.30	4 60				Co.	4 60						Sunday 10/15/11	2
73	John Doe							10	10	10	10	10																					60	.20	12 00	3 20			Sundry	3 00				6 00			3
4																																															4
5																																															5
81																																															80
	TOTALS							1/2	20	20	13	10																					13		16 60	3 20				7 60				6 00			81

Correct John Smith Pay Roll Clerk. Correct J. O. Loughlin Book Keeper. Approved A. Watson Treasurer. Paid Oct 14th 1911 Cash. Foreman.

XIV. CONTRACTING PRACTICE. Pay Roll.

Roll No. 2

John Doe
NAME

10/14/11
DATE

Contract No. 21 $ 12.00

ADDITIONS

Contract No. ____

" " ____

" " ____

Deductions ..... $ ____

Board	3 00	
Cash D'W'M.	3 00	

Net Amt. this Envelope 6 00

[redacted] Company
[redacted] BUILDING

XV. CONTRACTING PRACTICE.
Pay Roll Envelope.

hours. His time for Monday and Tuesday having been turned into the paymaster (possibly the contractor himself), the timekeeper made out his discharge check No. 320, Plate XVI, for the three hours on Wednesday, and the paymaster added the amount for Monday and Tuesday and paid him $4.60 upon surrender of his card, properly signed. Upon the payroll, Plate XIV, the paymaster then writes in the extreme right-hand column "Paid by discharge No. 320." John Doe, on the other hand, having completed a full week's work, is paid upon surrender of his card by a payroll envelope of same name, number and color, as shown by Plate XV, less the proper deductions.

Ordinarily it is assumed that large and important work requires daily reports, while small work, or where there is little changing around of men, can be reported weekly. In the first case by this system changing of distribution may be had to the closest half hour. In the latter case a separation four times a day would seem sufficient.

This system is flexible and can be applied to any organization, large or small. The cost of installation is small and the results attained more than justify the expense.

The payroll provides for deductions for various accounts, and the payroll envelope provides for a corresponding statement of the account of the workman, stating the gross amount of money earned, even if employed on various jobs, and giving deductions.

[redacted] COMPANY
[redacted] BUILDING

No. 3201 Contract No. 21 Date Oct. 11/1911

Roll No. 1

TO THE PAYMASTER: This Certifies that Richard Roe is entitled to pay for 3 hours labor @ 20 cents per hour as shown by the time sheets for pay-roll period ending 10/13 time ending 10/11

Amount 4.60 Correct: John Quick Timekeeper

Additions 4.00

Total 4.60 Approved: J. Kotlewski Foreman

Deductions 4.60

Net

XVI. CONTRACTING PRACTICE. Discharge Certificate.

Discharge No. 3201

Date 10/11/11

Name Richard Roe

Roll Ending 10/13

Time Ending 10/11

Hours 3 Rate 20 ¢

Amount 60 ¢

Contract No. 21

Roll No. 1

Standard Tests for Asphaltic Cements for Sheet Asphalt Pavements.*

By James W. Howard, Consulting Engineer, New York City.

FOR many years there has been great need of a definite set of standard chemical and physical tests to enable a properly educated and experienced person, equipped with suitable laboratory apparatus, to determine whether or not an asphalt-cement is good for use in constructing a sheet asphalt pavement and its underlying binder.

It is not necessary to state all the reasons why such a series or standard set of tests has not been determined and made public. It is sufficient to say that, in the early days of sheet asphalt pavements of the asphalt-cement, sand, stone-dust mixture type, there were no definite known tests, and that as separate tests were slowly devised, exact knowledge of what tests and standards to use was withheld from city officials and the public. This was done for commercial motives of control by those desiring to sell their brands of asphaltum or contracting to lay such pavements, also by the few semi-independent engineers and chemists, who have for a long time tested and determined the qualities and usefulness of asphalt cements.

An experience of more than twenty years constructing and inspecting pavements; selecting, preparing and using asphalt-cements in pavements, writing specifications, operating a road and pavement testing laboratory, determining the relative, scientific and practical qualities of paving materials of many kinds and deciding whether or not such materials met requirements or quality specified or needed for successful use, has compelled the writer to obtain and devise a standard set of chemical and physical laboratory tests, not only to be able to repeat old, successful pavements on new streets, but also to predetermine if new asphalt-cements made from materials from new sources of supply could be successfully used.

Asphalt-cement is one of the three direct component parts of the sheet asphalt layer (the other parts being sand and filler). It is one of the component parts of the binder (the other part being crushed stone or its equivalent). A city or independent contractor should not be concerned in the materials from which an asphalt-cement is manufactured nor how it is manufactured. Specifications should not mention or describe crude or refined asphalts, residuum oils or fluxes by name, description, tests or otherwise. No specifications or users of Portland cement dictate the source of supply, kind of limestone, or test ingredients from which Portland cement is made. Cities and contractors, except those interested in crude supplies, are not or should not be concerned with the ingredients of any asphalt or other cement. They should specify the qualities of the asphalt-cement ready for use; just as specifications for concrete foundations of pavements state what standard tests Portland cement must meet to be acceptable.

Many city specifications, including those suggested by certain associations, describe the various crude asphalts or refined asphalts, fluxes, etc., and how they shall be put together; but do not set forth a set of standard tests or criteria of excellence which the resulting asphalt-cements must meet to be good and acceptable.

Specifications emanated originally from various commercial sources and as the art developed and became general, the relics of those commercial influences are still apparent in all asphalt pavement specifications. This is shown either by the brand names of asphalts, as in Wichita, Kans., or by alleged tests, as in Philadelphia, and in Manhattan, borough of New York City, which tests do not determine quality but covertly describe controlled, limited crude or refined asphalts. All such specifications are made to "let in" or "exclude" one asphalt or another. All specifications should be so drawn as to include all materials which produce good results. This is best done in the case of asphalt-cements, as well as Portland cements, by having the specifications enumerate a set of tests which each must meet.

Many city engineers and independent contractors, above all suspicion of political or wrong motives, have unconsciously copied the objectionable specifications referred to; thus getting less competition and poorer pavements. It is evident that the tendency of associations or societies, containing commercial producers, has been to include in specifications materials produced by the commercial members and to fail to include materials not represented before committees or in open conventions.

The requirements of many past and existing specifications regarding crude asphalts, refined asphalts, fluxes and their various general combinations to make asphalt-cement, permit but do not insure

* A paper before the American Society of Municipal Improvements.

the production of definite, good asphalt-cements. None of such specifications contain sufficient tests and standards which asphalt-cements must meet, to either predetermine the qualities of such cements offered for use, or when extracted from existing sheet asphalt pavements, to determine whether or not they are good.

Specifications should omit all reference to crude and reefined asphalts, to fluxes and other component parts of asphalt-cements and set forth what definite qualities asphalt-cements must possess to be acceptable for use. A few experienced engineers and chemists, for many years, have tested asphalt-cements, manufactured and used them with success and know what qualities such cements must possess.

The writer, for several years, has prepared and used his standard chemical and physical tests for asphalt-cements for use in sheet asphalt pavements and in binder. He takes pleasure in now submitting this list in the interest of good pavements; hoping it will be another step toward placing sheet asphalt pavements on a definite, scientific, engineering basis.

It is well known that asphalt-cement is not the only ingredient of asphalt pavement of the type in general use in America. It is the ingredient, however, for which, up to the present time, no definite set of standard tests with degrees of excellence they must meet, is published. The qualifications and tests for sand, limestone, dust or other filler, proportions of mixtures and methods of constructing this pavement are known or easily obtainable.

The accompanying tabulation of what may be termed the "Howard standard tests of asphalt-cements for sheet asphalt pavement," is compiled from his laboratory records of tests of several thousand samples of asphalt-cements used in this type of pavement during the past twenty-four years. They represent the characteristics of all asphalt-cements made from all the many available refined asphalts and fluxes from American and foreign sources of supply and competing with each other. The fifteen samples (with one exception) enumerated as A. B. C., etc., represent all asphalt-cements which have met all required standards of good asphalt-cements during the past twenty-four years. The exception is sample IV, put in the table because it is successful in every respect except that it is seriously affected by water, as shown by tests Nos. 20, 21, 22 and 23, and makes a shorter lived pavement.

The last column of the table, headed "*Standard Tests Recommended*," shows the standards, criteria or degreees of excellence which, when all 27 tests are met, assure a city or contractor that he is using a good asphalt-cement in his binder layer or in his sheet asphalt pavement surface layer.

NOTES ON THE TABLE.

It is not necessary here to describe the methods of making the tests, because it is presumed that they will be made by properly educated and experienced engineers or chemists familiar with such testing or who can obtain the methods of making many of these tests from the publications of the Am. Soc. of Municipal Improvements, or the Am. Soc. for Testing Materials, U. S. Government and other publications. This society and others have heretofore confined themselves to careful descriptions of methods of testing, but have not determined what standards or criteria each test should meet nor have they determined a complete series or set of tests, which, if met, will fully establish the quality of asphalt-cement.

Test No. 1. The purity in bitumen indicates the presumable absence of deleterious matter; also whether one asphalt-cement, because purer, will produce more pavement than another.

Tests Nos. 2 and 3 indicate impurities which cost useless initial purchase price and freight or may or may not be injurious to the pavement because affected by water or otherwise.

Tests Nos. 4 and 5, while using the words "petrolene and asphaltine" (not definite substances) indicate the proper per cent. of solubility and non-solubility in standard naphtha of the bitumen in an asphalt-cement.

Test No. 6 is a method of obtaining the practical equivalent, with needed increased per cent., of test No. 4, in and near California, where it is difficult to obtain the standard naphtha of test No. 4, but where the uniform sulphuric-ether named can be obtained, which ether is obtainable everywhere, and because uniform should eventually replace naphtha test No. 4.

Test No. 7 simply suggests whether or not the asphalt-cement is pure bitumen and is of a kind in successful use in the past.

Test No. 8 gives the melting point with such accuracy that different persons can automatically get the same results and eliminates the personal equation.

Test No. 9 indicates the presence or absence of easily volatile matter and avoids unnecessary expensive apparatus.

Test No. 10 is the chewing test in practical use for many years. If an asphalt-cement cannot be chewed, but becomes like lard or slime, it is not good.

Test No. 11 is the usual well-known ductility test.

Tests Nos. 12, 13 and 14 are made with penetrating apparatus made by several competing makers; but the weight and time of penetration in each case is made

HOWARD STANDARD TESTS FOR ASPHALT-CEMENTS FOR SHEET ASPHALT PAVEMENTS.

(Samples A, B, C, etc., are asphalt-cements used from 10 to 30 years in many cities.)

Test No.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	—From Preceding— Max'm.	Min'm.	Standard Test required.
1. Solubility in carbon bisulphide, purity in bitumen, per cent	99.70	99.70	99.70	99.70	99.70	99.70	99.70	99.70	99.80	99.60	82.20	82.60	82.80	67.00	95.10	99.80	67.00	100 to 65
2. Organic matter, not bitumen, impurity, per cent	.20	.20	.20	.10	.10	.10	.10	.10	10	.20	3.80	3.10	2.20	5.90	1.60	5.00	.10	0 to 35
3. Mineral matter, not bitumen, impurity, per cent	.10	.10	.10	.20	.20	.20	.20	.20	.10	.20	14.00	14.30	15.00	28.00	3.30	28.00	.10	0 to 35
4. Petrolene, or solubility of pure bitumen in 75 B. etc., naphtha (Howard Standard), per cent	74.10	77.00	76.30	78.00	73.90	76.00	74.80	75.20	77.00	78.10	70.80	70.70	70.56	80.00	80.70	80.70	70.50	80 to 70
5. Asphaltene, balance of pure bitumen, per cent	25.90	23.03	23.70	22.00	26.10	24.00	25.20	24.80	23.00	21.90	29.20	29.30	29.50	20.00	19.30	29.50	19.30	30 to 20
6. Solubility of bitumen in sulphuric-ether U. S. P. 1900 (Calif. method), per cent	84.20	85.50	85.20	86.66	78.20	78.10	78.20	80.00	82.20	84.20	78.60	79.70	78.90	85.70	83.60	86.00	78.20	86 to 78
7. Spec. gravity	1.043	1.045	1.043	1.041	1.032	1.022	1.029	1.021	1.058	.9937	1.123	1.134	1.138	1.274	1.043	1.274	.9937	.993 to 1.25
8. Melting point (Howard mercury method), F.	140.00	142.00	146.00	144.00	158.03	160.00	160.00	174.03	150.00	150.00	162.00	160.00	160.03	172.00	150.00	174.00	140.00	140 to 174
9. Flash open crucible, F.	486.00	480.00	600.00	490.00	440.00	440.00	440.00	450.00	490.00	526.00	460.06	420.00	440.66	470.00	460.00	600.00	420.00	400 to 600
10. Chewing test during 15 minutes	good	good	good	good	good	good	good	good	good	good	good	good	good	good	good	good	good	good
11. Ductility at 77 F. 1 sq. cent. cross-section; broke at length, centimeters	103.00	100.00	100.00	99.00	90.00	28.00	27.00	21.00	41.00	24.00	14.00	13.00	22.00	25.00	30.00	100.00	13.00	10 to 100
12. Penetration, consistency or softness at 32 F. No. 2 needle, 100 grs., 5 secs. (Howard uniform method), centimeters	.03	.03	.02	.05	.07	.10	.09	.08	.07	.11	.09	.10	.09	.05	.04	.11	.02	.11 to .02
13. Penetration, consistency or softness at 77 F. No. 2 needle, 100 grs., 5 secs. (Howard uniform method), centimeters	.57	.56	.57	.63	.57	.62	.63	.62	.60	.70	.65	.65	.67	.60	.67	.70	.56	.50 to .75
14. Penetration, consistency or softness at 100 F. No. 2 needle, 100 grs., 5 secs. (Howard uniform method), centimeters	1.90	1.92	2.11	1.98	2.50	1.59	1.58	1.55	1.35	2.72	1.75	1.80	1.90	1.90	2.05	2.72	1.35	1.35 to 2.70
15. Pliability on breaking glass at 32 F (Howard method)	slight	slight	slight	fair	fair	fair	fair	fair	fair	good	good	good	good	slight	slight	good	slight	slight
16. Evaporation, 50 g. at 212 F., 1 hr. loss of weight, per cent	0.00	0.00	0.00	.01	.01	.01	.01	.01	01	0.00	trace	trace	trace	.80	.11	.80	0.00	0 to .8
17. Evaporation, 50 g., at 325 F., 5 hrs. loss of weight, per cent	.42	.64	.33	.26	1.20	1.19	1.44	.63	.48	.29	.35	.48	1.10	1.38	2.04	2.04	.26	.2 to 2.5
18. Penetration of residue after test 17 No. 2 needle, 5 secs., at 77 F., centimeters	.38	.40	44	.42	.29	.35	.34	.42	.40	.64	.44	.45	.52	.30	.45	.64	.29	*
19. Hardening of residue of No. 17 compared with pen. of A. C. test No. 13, per cent	33.00	29.00	23.00	33.60	49.00	44.00	46.00	32.00	33.00	9.00	32.30	31.00	22.00	50.00	33.00	50.00	9.00	50 to 0
20. Water effect on A. C. coated on glass, immersed one week, waterproof or water weakness	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	soft	greyish	soft	0.00	greyish—0
21. Water effect on A. C. coated on glass, immersed 30 days, waterproof or water weakness	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	decay	grey	decay	0.00	greyish—0
22. Water effect on cylinder of sand and A. C., immersed one week, waterproof or water weakness	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	soft	greyish	soft	0.00	greyish—0
23. Water effect on cylinder of sand and A. C., immersed 30 days, waterproof or water weakness	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	decay	grey	decay	0.00	greyish—0
24. Adhesion at 32 F. 1 sq. in. in sec Howard St'd briquette sand and A. C. broke; lbs. tension	363.00	352.00	347.00	327.00	312.00	261.00	182.00	180.00	293.00	157.00	253.00	206.00	206.00	348.00	267.00	363.00	157.00	Above 150
25. Adhesion at 77 F. 1 sq. in. in sec Howard St'd briquette sand and A. C. broke; lbs. tension	94.00	80.00	75.00	60.00	53.00	63.00	47.00	40.00	41.00	25.00	38.00	34.00	37.00	76.00	29.00	94.00	25.00	Above 25
26. Compression at 32 F. Howard St'd cylinder sand and A. C. crushed at lbs. per sq. in.	1290.00	1202.00	1153.00	975.00	750.00	831.00	634.00	565.00	787.00	422.00	662.00	664.00	648.00	1180.00	703.00	1202.00	422.00	Above 400
27. Compression at 77 F. Howard St'd cylinder sand and A. C. crushed at lbs. per sq. in.	170.00	222.00	169.00	181.00	235.00	185.00	257.00	127.00	229.00	116.00	169.00	154.00	155.60	222.00	159.00	257.00	116.00	Above 110

*Variable to get No. 19.

to conform and not irregular as often heretofore used. Therefore uniform penetration curves or increasing softness under increasing heat can be platted. All variables are eliminated except the one of softness or consistency of the cement being examined.

Test No. 15 is made on glass and determines if the cement is brittle or not when the glass is broken.

Tests Nos. 16, 17, 18 and 19 are well known and indicate the stability or durability of an asphalt-cement when exposed for years to hot weather.

Tests Nos. 20, 21, 22 and 23 determine whether or not an asphalt-cement, in thin films between the particles of the mineral aggregate of a pavement, will be injured and decayed by the action of rain and other water on, in or under a pavement.

Tests Nos. 24 and 25 are made upon briquettes composed of special standard clean sand and practically pure bitumen of the asphalt-cement, compressed to constant density in an apparatus and machine permitting several thousand pounds pressure per square inch. Adhesion is one of the most essential qualities of asphalt-cement and not to be opposed from any engineering standpoint. The use of this test is of great help toward securing good pavements.

Tests Nos. 26 and 27 are made on larger and different shaped briquettes of the same composition and compressed in the same way as tests Nos. 24 and 25; but tests Nos. 26 and 27 while indicating adhesion, determine cohesion, which in sheet asphalt pavements depends almost entirely upon the asphalt-cements used in the pavement mixture.

Conclusion: To fully determine whether or not an asphalt-cement is good for use in sheet asphalt pavement, it is necessary to make the entire set or series of twenty-seven standard tests shown in the tabulation and have them meet the requirements indicated in the last column. The climate, kind and quantity of traffic, the location of the pavement to be constructed in respect to exposure to sun and other environments, must be considered, and the consistency, softness or penetration adjusted accordingly, but (with very few extreme special exceptions) within the limits indicated by tests Nos. 12, 13 and 14; the other tests remaining within the limits set forth in the last column of the tabulation.

This group or set of tests and criteria will not determine the qualities of asphalt or bituminous cements for bituminous stone poured and mixture pavements; for which special cements the author hopes to some day submit a standard set of special tests.

Bituminous Concrete Pavements.*

By H. G. Lykken, C. E., Grand Forks, N. D.

TO begin with I wish to define a Bituminous Concrete Pavement as a pavement composed of a compressed composition of crushed rock, sand and mineral dust aggregate with a binder of either coal tar pitch or asphalt cement, mechanically mixed before being spread on the roadway. While not considering the ordinary form of sheet asphalt pavement strictly a bituminous concrete, it may be considered under the same heading; for, after all, it is but an asphalt binder and a mineral aggregate somewhat finer than that in the regular concrete, yet otherwise the same. We may in one sense call a mixture of hydraulic cement and sand a concrete, as well as the mixture in which the aggregate is purposely coarser. In fact, our modern conception of a true concrete with its minimum voids in the aggregate, and all that, began with the sand and cement mortar of ancient origin to which more or less crushed stone and gravel aggregate was added.

I cannot help think of the analogy between a hydraulic cement and a bituminous cement concrete, and the development of both from the cement and sand mortar; only in the former no one thought of securing a patent on the gradation of the mineral aggregate. The evolution of the coarser mixture from the finer was analogous and inevitable in either case.

Little time can be given here to anything else but the surfacing material, but I wish to state in passing that, in my opinion, all composition pavements should have a Portland cement concrete or vitrified brick gutter of generous width. On slow grades, especially, it is a difficult matter to get a true gradient with a material that has to be compressed in place. If the gutters are built with Portland cement concrete or brick, laid true to line and grade, as they easily can be, a much better job can be had of the composition surface. But the chief advantage is the added life of the pavement. The best bituminous composition will deteriorate from action of the street fluids that accumulate along the gutter line,

*From a paper before the American Society of Municipal Improvements.

where the pavement is generally left porous from insufficient compression as the rollers cannot work close to the curb. Generally this becomes the weak point in the pavement which, with the other construction, forms a sanitary and easily cleaned surface.

The gutter should, however, be a part of the pavement area, and not a part of the curb built separate and distinct from the roadway proper. This is especially necessary where frost may cause a relative displacement of the curb and gutter, as I have seen in so many places.

It will be generally conceded, I take for granted, that a Portland cement concrete foundation is preferable to macadam, bituminous macadam or any other kind of base for a bituminous concrete pavement. Such a pavement must, above all things, have a uniform and rigid foundation. It must be uniform and laid to the correct contour of the finished street surface, as no raker can so gauge the thickness of his material that a dip will not form over every low spot in the base, as the thicker layers of the hot mixture compress more under the roller.

In the greater ease with which a uniform surface can be formed with concrete offsets, in the saving in the material of the bituminous surface and the labor of getting a smooth roadway, lies a considerable part of the possible difference of cost. Besides, lower prices of cement and the development of labor-saving mixing machinery makes a concrete base cheaper in most cases; in more cases, at least, than many users of macadam or bituminous macadam foundation realize.

In laying the concrete base for a bituminous pavement, I have always made it a practice to have the concrete fairly wet, so that it would compact with its own weight, or with slight tamping with the shovel. The finished surface of the base is left rough by drawing the edge of the shovel over it so as to bring the coarse aggregate to the surface. With properly graded gravel it is possible to produce a surface on which I would not hesitate to place even a sheet of asphalt pavement without the use of the binder course.

The object of the roughened surface is, of course, the same as the object of the binder course in sheet asphalt construction—to prevent any tendency of creeping.

Coming back to the surfacing material, I wish first to consider the mineral aggregate. As already stated, I consider it a natural evolution of composition pavements, such as sheet asphalt, to have substituted for the finer and inherently unstable aggregate one which is coarser, graded as to size and inherently stable. I mean here by stability, resistance to pressure and displacement by flow or creeping.

In a sand asphalt composition there is no resistance to pressure and flow as far as the aggregate or sand is concerned. The particles are all free to move but for the resistance offered by the cementing material, and the adhesiveness with which it connects the mineral particles must necessarily be the net resistance it can offer to the displacement of same.

In a graded aggregate where the size of the particles are to some extent commensurable with the thickness of the layer, an entirely different condition obtains. The aggregate itself will resist both pressure and lateral displacing forces. The cement serves to equalize the strains and adds to the resistance, but is relieved from possibility of excessive distortions and resulting weakening.

It seemed natural to add crushed rock to hydraulic cement mortar, and equally natural to develop an inherently stable aggregate as the modern conception of a good hydraulic concrete. It should seem equally natural to treat a bituminous mixture in the same manner. And as far as can be learned, the first attempt at making a bituminous concrete was by adding to the bituminous sand mortar or standard sheet asphalt mix the crushed rock with little consideration paid to its grading and sizing. The inherently stable aggregate came as a matter of course.

The doctrine of a stable aggregate, if it can be termed that, is finding a constantly wider acceptance, but there exists a greater diversity of opinion as to the proper size of the mineral particles. The earlier tendency was towards a coarser mix, up to two inches for the maximum size, as though the pendulum had swung from one extreme to the opposite in departing from the sand aggregate. Later much fine material has been used and considerable paving laid with a mixture grading from two mesh, and even less, as the maximum size.

Assuming that two inches is the proper and economical thickness for an asphalt concrete pavement subject to ordinary traffic, which is perhaps as nearly what it should be as has been determined to date, (for it must be thick enough to have a body of its own, aside and apart from the base, capable of resisting contraction strains, shocks and distortions, have depth so that the oxidation and gradual loss in elasticity, naturally going on in the surface layer will not appreciably reduce the total cohesion of the mass, and for proper manipulating in laying and rolling, yet not be too deep so as to waste material), we are left to determine the proper maximum size for such a thickness.

And here I consider results in the mechanical operation of raking or spreading the hot material on the street to take

precedence over theoretical considerations. There is a pronounced tendency for the coarser particles to segregate in raking and drawing the layer down to the proper thickness. This is not so noticeable and is even entirely absent in a finer mix. I have gotten the best results with an aggregate grading from one and one-half mesh lown. It may be that a slightly coarser aggregate, even one with the maximum size equivalent to half the depth of the finished layer could be used to advantage if properly put down, but under ordinary working conditions a mixture must be supplied which will insure a homogeneous pavement. The finer mix is more easily manipulated under the roller as well, making a smoother street and having less tendency to pit or show an open surface. The tendency to ravel and the larger stones in the aggregate to crush or loosen is also eliminated.

As this size of approximately one-third the depth of the pavement layer for the largest particles in the aggregate seems to be the largest size that will give the best results in the mechanical operation of laying it, I fail to see why larger stones should be used, and I do not think a coarser aggregate would make a more inherently stable mixture.

In grading the mineral aggregate, the same working conditions will limit the theoretical ideal mixture to what the commercial sizes of rock will afford. There is a limit to the number of screens that can be practically used on a mixing plant. While the maximum density of the finished product may always be in the engineer's mind, what he really gets in the long run under the best of conditions is a fairly well graded aggregate of rock particles with the voids filled with a mortar of sand, mineral dust and bituminous cement. That is really what all concretes are commercially, after all, and all that can be expected.

The rock should be hard, but more particularly tough in character, and should have a cubical fracture. If it comes from the crusher such that it ranges in size from one and one-half mesh, or the largest size specified, down to ten mesh, or with all passing a ten mesh eliminated, and in such manner that its mass density cannot be appreciably increased by addition of a quantity of intermediate screen, it can well be considered acceptable. The material screened out in passing the ten mesh screen and grading to impalpable dust, together with clean moderately sharp graded sand, whatever additional dust filler is necesary, and the bituminous cement will constitute the mortar. No hard and fast rule can be established for the proportions of the various ingredients in this mortar. The nature of the bituminous cement used, the sand, climate and traffic conditions, are all factors that must be considered. The finer rock screenings and sand dust must, of course, be used in quantities sufficient to give a certain volume and body to the mix, and the finer dust added in such proportions as to give the proper consistency or stiffness.

The finished pavement will have from 35 to 45 per cent. by weight of this mortar, or a slight excess over that necessary to fill the voids. The pavement will be in effect a graded rock aggregate, not too coarse, but inherently stable and of hard, tough material, having all voids filled with the bituminous mortar; and having sufficient mortar in excess to close fairly well under the roller.

It is a bituminous concrete pavement in every sense that a hydraulic or bituminous cement concrete can be that commercially; but not, as may be well admitted, in the sense of being a mixture graded from the largest particle to impalpable dust in such a manner as to have a minimum of voids, which voids are to be filled with the bituminous cement alone.

There is a greater difference between these two propositions than is first apparent. A mineral aggregate can be well graded and inherently stable, at least for all practical purposes, and be far from having the least possible voids. In such an aggregate it is evident that all voids and interstices will be filled with the mass and volume of the mortar. The rock particles will have a bedding of mortar acting in the three-fold capacity of a cushion, a binder and a matrix, while an aggregate graded so as to possess minimum voids has smaller mineral particles filling the voids between the larger ad infinitum, with but a film coating of the cement between the adjacent surfaces. Such a pavement with an absolute gradation would be hard and nonelastic as the rock of which it is composed.

In the matter of binder or cementing material there is possible a greater diversity of opinion and difference in the character of the product offered the trade. Not only have we far from a standardized bituminous cement, but lack anything that might be called standard specifications for such a material.

It goes without saying that a paving cement must be, first of all, stable and unaffected as far as possible by oxidation and the action of fluids met with in the street. It must not be subject to disintegration by the temperature to which the rock may be heated in mixing, nor by the interaction or breaking up of its own component chemical combinations.

Within the range of temperature to which the pavement may be subjected,

the cement must have a certain fixed cementing quality or adhesiveness, a certain quality of elongation in accommodating itself to contraction of the mineral aggregate due to temperature changes, or ductility, and a certain quality of plasticity usually referred to as penetration.

But a certain factor of adhesiveness at a given temperature is not sufficient, as this quality varies greatly with the changes in temperature. Tests must be taken along the entire range to which the pavement will be subjected, and somewhat beyond both extremes. Such a series of tests could be represented by a curve, termed a curve of adhesiveness. Obviously the cement having a fair and fairly constant factor of adhesiveness would serve all purposes best in this one particular. The cement which at the highest and lowest temperature to which a pavement may be subjected loses that quality is evident deficient.

There are on the market bituminous cements that at certain temperatures excel in this particular but which with a variation from this temperature diverge most extraordinarily. Many of them, while they may be used in the limited climatic range of some localities, become worthless under conditions where the range in temperature is wider.

But as this quality of adhesiveness is intimately related to the sand-carrying quality of the cement, the force required to part two surfaces cemented together with any given sample does not become a true index to its value for paving. In the pavement as laid in the street it is rather the adhesiveness with which the sand and cement mortar holds the coarser aggregate in place, and with which the mortar itself holds together, that deter-

A comparison of the slag with various range of temperature as far as adhesiveness is concerned when tested neat for that quality alone, but when mixed in the mortar, with the same amount and quality of sand and dust filler to produce mines its value. Two given cements may correspond very closely within a given the necessary stiffness or body, the one may be all that can be desired, while the other will be so "short" as to have little or no cementing value.

Thus the cementing quality of the mortar becomes the true criterion; not only that, but the cementing quality of the mortar prepared with the sand and dust materials available on the job for which it is to be used.

In the same manner a curve of ductility covering the same range in temperature would reveal the possible behavior of the pavement under all conditions. A certain ductility at 77 degrees F. means nothing when one cement passing that test may be sufficiently ductile at zero and a range below, while another making an equally good showing will become more brittle than glass.

The ideal cement will have a fair factor of ductility (much is not necessary), but more important, a fairly constant one for all temperatures to which the pavement will be subjected. There are cements on the market having ductility to spare at the right temperature, which crack with the first chill.

A curve of penetration covering the same range of temperature would indicate the nature of the cement, not at certain ideal temperatures alone for that particular material, but at the most trying temperatures to the pavement, when it is too hot or too cold. The ideal cement would have a uniform factor of penetration for the entire range of temperature and not, as some cements on the market, a range from zero to infinity under actual working conditions.

In this connection I wish to submit that a simpler and better method of making the penetration test is to observe the length of time taken by a needle of a given size and given weight to penetrate, say, one centimeter, or any other convenient depth, into the material tested. The apparatus can be much simplified and will consist of a needle fixed to move in vertical guides and weighted with a weight constant for all tests. On the guides will be arranged a centimeter scale reading with a vernier. As the needle is released and after it has begun to penetrate the material, i. e., after it has penetrated the surface film, the zero reading is taken, and the time consumed in penetrating one centimeter, or any other convenient depth, noted. The time becomes the variable in this case and is easily and accurately determined. The penetration apparatus itself is very simple and capable of greater refinement in the test. The skin effect of some cements under certain temperatures is eliminated, as the penetration observed is that of the body of the cement alone.

To sum up: The paving cement should be stable, unaffected by oxidation, street fluids, the temperature used in mixing, chemical changes and interaction within itself. It should possess, throughout the entire range of temperature to which the pavement will be subjected, a fair degree of adhesiveness, that the particles of the mineral aggregate may be held in their relative position; a fair degree of ductility, that the pavement may accommodate itself to the expansion and contraction due to temperature changes; and a fairly uniform penetration, that the street may possess a uniform hardness and stability.

These requirements eliminate the

various coal tar pitches and fluxes high in the paraffine scale and narrow down to the better grades of asphalt products. Thus a good bituminous concrete pavement must necessarily be an asphalt concrete pavement.

We have then a pavement consisting of a hard and tough rock aggregate, fine enough so that the larger particles will not segregate in the raking and spreading on the street and graded so as to be inherently stable, having all the voids and interstices filled with an asphalt, sand and dust mortar in such a manner that the rock particles are thoroughly imbedded, and retained as well as cushioned in the matrix. Such a pavement will close fairly well under the roller and will need little if any surface dressing of the asphalt cement. It should have none smeared on the concrete base lest careless workmen put on an excess which will work up into the pavement and make it too soft.

The asphaltic mortar will have very much the same composition as a mix for standard sheet asphalt, except it will be richer in the cement, though the total mix will contain perceptibly less. The pavement will have all the advantages and desirable qualities of the sheet asphalt with its chief drawbacks—susceptibility to heat, softness, creeping and excessive wear—eliminated. With further improvement in the asphaltic cements, making them more adaptable to the wide range in temperature to which our pavements in the north are subjected, asphaltic concrete affords an ideal paving material.

I look upon bituminous concrete, or, as I should put it, asphalt concrete, as an improved form of the old asphalt pavement. It has been with us now long enough to prove its superiority. But because it partakes of a crushed stone aggregate, it need not go to the opposite extreme of being all stone graded to the elimination of voids except such as are to be filled with the bituminous cement. In this way it need not conflict with any patent rights, and is a far better pavement for not infringing or attempting to follow any patented formula.

The best pavement will have a rock aggregate with the voids ranging from 30 to 35 per cent. which are filled with the asphaltic mortar. Such a pavement will have all the stability necessary, yet have a quality of elasticity that adds materially to its life and wear. It will naturally take a little more cement or bitumen which, however, I consider a virtue, as the extra amount remains in store in the pavement replacing the natural loss due to oxidation and other possible causes.

Bituminous Concrete Pavements.

Discussion by George C. Warren, Boston, Mass.

MAY I be permitted for a moment to call attention to the fact that just ten years ago, Fred J. Warren, first brought to the attention of the public the theories of his new construction, from which theories the Bitulithic pavement has developed.

Then there was little except his theories, supplemented by two years' laboratory investigation; one patent issued and some twenty others pending and three pieces of pavement, aggregating less than 4,000 sq. yds., then in use less than six months and now more than ten years old and in first-class condition, with no repairs necessary during that period. At that time, every one said that the theories were novel. Most engineers agreed they were reasonable but all regarded them as largely experimental.

I think we can be pardoned for referring with pride to the result of a decade during which the pavement has been laid throughout the United States and Canada to the extent of over 19,000,000 sq. yds.

Finally, it is most gratifying to find such an able paper as that under discussio now proclaims "as most natural" principles so closely reiterating my brother's theory of ten years ago.

I want to express my entire agreement with the paper in the use of Portland cement and brick gutters on flat gradients in connection with bituminous pavements but from somewhat different reason than "deterioration from action from the street fluids." Any bituminous surface which depends on rolling for its compression cannot be laid to either as true a grade or as great a lateral slope as gutters should have, because the roller will, necessarily, flatten the lateral slope. The roller will also leave a slightly wavy gutter and water will not flow as freely as it should. Gutters of cement or brick set in concrete and grouted, on the other hand, can be laid to a straight edge to absolutely true grade and good lateral fall and allowed to set without being disturbed. My judgment and observation is that, generally

speaking, a width of gutter of twelve to eighteen inches and a lateral fall of one inch per foot is best.

The clear statement of the importance of "fixed cementing quality or adhesiveness" in the paper, is the first published statement I have seen on this important physical property.

About seven years ago Mr. A. E. Schutte devised, and, in Warren Brothers Company's private laboratory practice has regularly used, an apparatus for accurately testing the "cementing strength" of bitumen, measured by the breaking strain of compressed bars, made of sand of standard quality and size, cemented together with ten per cent. of bitumen. This test for "cementing strength" is the measure of co-hesiveness. Adhesiveness is the ability of the bitumen to hold the mineral together under stress. Co-hesiveness, or ductility, is the ability of the bitumen to hold its own particles together under stress. The two properties being closely allied, the results of the tests for ductility and cementing strength bear a close ratio to each other. We find that the materials sold on the market as asphalt vary as widely as one to twenty in ductility and one to five in cementing strength. In my judgment the value of the ductility test is not the ability of the material "to accommodate itself to the expansion and contraction due to temperature changes" as much as its indirect measure of cementing strength of the bitumen at varying temperatures.

No given bitumen has, to a maximum degree, all of the most desirable physical properties. In my judgment, the four essential properties of a bitumen are in the order named:

1. Cementing strength.
2. Ability to withstand moisture without deterioriation.
3. Range of flexibility at varying temperatures.
4. Purity, which is only scientifically valuable insofar as the impurities are soluble salts, organic or other matter liable to cause deterioriation, although from the point of view of economy purity is of vast importance.

As to the mineral aggregate, I cannot agree that mortar whether hydraulic or bituminous should ever be called concrete. There should be kept, a clear, sharp distinction and I hope the committee on nomenclature of the society will, in its report, preserve and clearly define the correct distinction which I understand to be as follows:

Mortar is a mixture of fine aggregate, sand or its equivalent, and a cementing medium.

Concrete is a mixture of coarse aggregate, stone or its equivalent, and mortar, and in the concrete, the coarse aggregate should predominate, and the fine aggregate be used in proper proportions to fill the voids of the coarse aggregate, and provide an overplus of say five to ten per cent.

Any "mongrel" combination should be classed as "mortar" or "poor concrete" as it most nearly approaches either of the above definitions. The term aggregate in hydraulic or bituminous cement includes all material in either mortar or concrete except the cementing medium and that, in concrete, it is divided into "coarse aggregate" and "fine aggregate." As the paper says, there is an analogy between a hydraulic cement and bituminous cement concrete but to avoid misinterpretation the terminology should be clear and distinct and no perplexing interchange of terms permitted or practiced.

(Samples of bituminous mixtures made under specifications requiring "bituminous concrete" and one of ordinary sheet asphalt mixture were shown and commented on as follows:)

All of these are properly "bituminous mortar" although containing a sprinkling of very fine stone. All are porous unstable mixtures carrying a high percentage of voids. The paper very clearly makes the proper distinction between "finer and inherently unstable aggregate" and "one which is coarser, graded as to size and inherently stable" and says "I consider it a natural evolution of composition pavements." In a sense that is true, and in a similar sense the telephone is the natural evolution of the telegraph, combined with the principle of hearing through vibration of the ear drum by sound, but that "natural evolution" made the telephone none the less novel.

Prior to the development in accordance with the patents under consideration the efforts to produce bituminous surface of coarse aggregate were along the line of laying the materials in layers thus closely following the principles of John Macadam in water bound stone roads. This was shown in the testimony in the litigation which has occurred.

Another statement in the paper, referring to hydraulic concrete, is that "no one thought of receiving a patent on the gradation of the mineral aggregate." Perhaps that is only because such grading of aggregate, as practiced in ordinary hydraulic cement concrete, was done before the world had come to appreciate the value to the community of encouraging inventions through allowance, for a short term of years, of a patent franchise.

The analogy between a hydraulic cement and bituminous cement concrete is by no means as clear as Mr. Lykken indicates, for the reason that in the hydraulic cement the bonding effect is produced by the chemical action or crystallization, which takes place when water is added to the hydraulic cement, while in the bi-

tuminous concrete the bonding is effected exclusively by the adhesive properties of the cement used, and the proper combination of the different sizes of the mineral aggregate, which latter is not at all essential in the hydraulic cement concrete, except as an element of economy in construction.

It is also a mistake to trace this analogy to "a development from the cement and sand mortar," for the reason that the whole tendency of the development of a bituminous cement and sand mortar was to produce "solidity," not "stability," by grading the fine particles down to still finer even by the use of a small portion of dirt or filler in the mixture. It was not until very much later and comparatively recently that the use of a coarser aggregate, properly graded as to sizes, was found to be possible with the use of a bituminous cement in the wearing surface of street pavement construction. It is this radical difference in the development of the latter day bituminous concrete construction, from that which had been practiced for years before, that made the issuance of a patent possible to the man who first made a practical demonstration of this radical difference in the construction of bituminous street pavement. The principal effect to be accomplished by the grading of stone in hydraulic cement concrete construction is economy in cost, whereas in the bituminous construction it permitted the use of a softer more durable cement and also added to the "stability" of the mineral structure itself, all of which advantages were novel in bituminous cement structures and were each covered by separate claims of the patent to which the paper refers.

The author says: "I mean here by stability resistance to pressure and displacement by flow or creeping." In this he clearly recognizes the essential difference between "stability" and "solidity" in the wearing surface of a bituminous street paving material, and brings out the essential ground upon which the validity of the patent to which he refers has been sustained by the courts; and that is that the use of coarser material and the proper grading of the mineral aggregate in a bituminous structure so as to produce "stability," "resistance to pressure and displacement by flow or creeping," had never been accomplished before, for the reason that the only effort prior to that time had been to produce "solidity" by the use of still finer material, which necessarily required the use of a harder shorter lived cement in order to hold the finer particles in place, which in themselves possessed no "stability" or power to "resist pressure or displacement by flow or creeping."

It was this broad distinction between "stability" and "solidity" as applied to the wearing surface of a bituminous street paving structure that enabled the inventor to secure a valid patent on a bituminous street paving structure having "stability," a minimum of voids, and permitting the use of a softer and more lasting cementing material, but which would not have justified the issuance of a patent on the same character of construction with hydraulic cement.

The fundamental error in the paper, as it seems to me, is the assumption that the development of "an inherently stable aggregate in the modern conception of the good hydraulic concrete" would seem equally natural in the development of bituminous concrete, and is due to a total failure upon the writer's part to distinguish between the above described functions which "an inherently stable aggregate" performs in the two classes of construction.

That the author of the paper under discussion and others skilled in the paving art should now come "to look upon bituminous concrete as an improved form of the old asphalt pavement," and regard its superiority of construction, now that "it has been with us long enough to prove its superiority" as a self-evident fact so simple that every one must have known it, is the highest evidence possible of the real invention and patentability upon the part of the person who first "proved its superiority" in the face of the most bitter and relentless opposition from those engaged in laying "the old asphalt pavement" or what Mr. Lykken correctly terms "an asphalt mortar."

Returning to the importance and size of aggregate for the wearing surface of bituminous concrete, the paper suggests that the maximum size of the mineral aggregate should be for a wearing surface two inches thick, "one and one-half inch mesh"; again the "maximum size eequivalent to half the depth of the finished layer," and again "approximately one-third the depth of the pavement layer." Our practice on this point has always been to have the maximum sized stone in the aggregate forty to fifty per cent. of the thickness of pavement surface, except that on crushed stone or bituminous base a larger sized stone may be used, because a considerable portion of the larger particles of aggregate will crowd down into the spaces between the corners (generally three-inch stone) in the foundation and in reality make the total wearing surface fifty per cent. greater than the two inches specified. Incidentally this is one of the advantages of bituminous base above referred to, provided the subsoil is of a character which can be rolled solid. The very first pavement laid under our patent (Park Place, Pawtucket, in May, 1901) was laid on an old tar pavement to a thickness of one and one-half inches and

the largest stone passed a three-fourths inch ring,—say one-half-inch stone or one-third the depth of the pavement surface. I agree with the suggestion of the paper that the smallest sized stone might be one-third the thickness of the surface, which provides, with a two-inch surface, maximum stone two-thirds of one inch size (say passing a one-inch ring), would not be bad practice, although stone up to passing one and one-quarter-inch ring, say one-inch stone, could be used with equal propriety

The idea which people have, and which has been pushed in legal attacks on the patents, that they are confined to a certain sized maximum stone is entirely erroneous. For instance, one patent, referring to stone up to three inches, also says the surface may be laid to any thickness but a thickness of one to three inches is preferred. Surely that carries with it the clear idea of the inventor and the patent that the maximum sized stone may be less than one inch because it is impossible to lay a one-inch surface using stone greater than one inch size.

The fundamental point of the basic and adjudicated patent is that the aggregate shall not be so proportioned as to provide "inherent stability" or "less than 21 per cent. voids." Note that the two points are separate and are covered by distinct claims and that the two points may not necessarily be, although they generally would be, in the same structure. The most accurately graded aggregate with maximum sized stone about two-inch size will have voids as low as ten per cent. The only limit as to maximum size of stone in this patent is that it shall be "greater than one-fourth inch."

The closing paragraph of Mr. Lykken's paper clearly shows how closely his ideas conform to the patent and practice. The paper provides for "a rock aggregate with the voids, ranging from 30 to 35 per cent., which are filled with the asphaltic mortar." Let us briefly analyze this:

Voids in rock	30 to 35 per cent.
Provides coarse aggregate equivalent in weight to solid rock	70 to 65 per cent.
Assuming the mortar to contain at least enough bitumen to coat the particles of all aggregate both coarse and fine, it would have about twenty per cent. bitumen and yield fine aggregate (sand or stone finer than 1-10 inch)	24 to 28 per cent.
Bitumen	6 to 7 per cent.
Total	100 per cent.

Reducing this to percentage of aggregate, exclusive of bitumen we find:

Coarse aggregate, which the paper defines as coarser than 1-10 inch	75 to 70 per cent.
Fine aggregate, passing No. 10 screen	25 to 30 per cent.
Total	100 per cent.

I think it is better practice to consider everything passing one-fourth-inch mesh as "fine aggregate" and that remaining on one-fourth-inch mesh as "coarse aggregate."

Mr. Lykken's formula would provide compacted mineral aggregate having from 10 to 15 per cent. of voids, depending on the grading of the aggregate within the general proportions specified, and depending on the character of stone used and the kind of crusher used for producing the crushed stone, and would most clearly come within the specifications and claims of the patent referred to and would produce a very high degree of "inherent stability" and low percentage of voids.

Roads in New Jersey and their Repair.

By James Owen, Consulting Engineer, Newark, N. J.

THE state of New Jersey may be considered the pioneer State for systematic road development. As far back as 1868 the legislature passed a law enabling Essex county to lay out and improve roads in that county. Taking profit by that example other counties followed suit and many hundreds of miles were constructed in northern Jersey, under either the macadam or Telford process with trap rock as the material.

Stimulated by the example of the different counties the local municipalities also began a systematic construction on the same lines.

Nearly twenty years ago the State Aid law was passed, the first in this country, providing that the state should pay one-third of the cost of construction, the town ten per cent. and the balance by the county. This so stimulated the construction of roads that it may be confidently stated

that up to date New Jersey has a greater proportion of hard roads than any other state.

For road purposes the state may be divided into two districts, the northerly part with only stone available, and the southern part with nothing but gravel. In the early practice gravel did not find much favor, and so miles of stone roads were built in the gravel country, but with later experience this practice has been modified.

In the early days of road construction and maintenance iron tires and horses' hoofs were the only irritants to be considered and experience finally gave good results economically and physically in the shape of a good, hard, smooth surface at all times when repairs were systematically made. It must be said, however, that the subject of maintenance was not always looked upon as a necessity, and in some sections the roads were allowed to deterioriate.

The stone used in the northern part of the state was chiefly trap rock, the best for such work. Where granite was available, it was used, but as the granite was in the less populous districts there was consequently less travel, and the results of the use of the two materials were about even.

Up to eight years ago the roads of this state were accepted as ideal and were noted throughout the land. Their condition was inviting, and of course travel increased, but their condition remained excellent until the automobile entered the scene. At first, when there was but a small number of cars, their effect was not apparent and no appreciable change was noted in the surface, but as they increased in numbers two results were clearly shown, the ravelling of the surface and the volume of dust. The first condition was only appreciated by the person in charge of the roads, but the second became a public menace and popular demand immediately arose for the suppression of the dust nuisance. This point must be strongly noted, as if the dust question had not arisen with the force it did, the maintenance of the road for the automobile travel alone would not be so complicated.

With this popular demand for dust suppression, there arose in the market every possible panacea for the evil. Each had its earnest advocate with alluring argument and instances of sporadic success. The average road man, whether constructor or maintainer, was at sea, as he had had no experience in these new curatives and could not appeal to his likes for help. Consequently the only thing to do was to experiment, and this country, and it may be said the entire civilized world, is still experimenting, and it is to be hoped that in the early future some crystallized practice may be evolved that will give at least ninety per cent. efficiency instead of about forty.

The writer has experimented with all kinds of asphaltum oils, heavy and light, with calcium chloride, dustolene and Tarvia, and noted results, arriving at the following conclusions:

That for economical reasons the road maintenance of the country can not be vested in experts using material requiring expert approval. That a system must be evolved that can get good results with ordinary common intelligence. That under the old system of construction and maintenance, such results were achieved, not, of course, universally but generally. That a mere modification of the old regime suitable to automobiles and dust suppression is all that is necessary.

The experience arrived at in this section is, build your roads in the same old way, viz: of water bound macadam or gravel and repair them in the same old way. This insures a smooth surface which was hard to get in the heavy oil mixtures. Then coat according to its travel, with light oil with not more than 38 per cent. asphaltum, as often as the necessities of dust suppression require. This is what is now being done in this section and gives a smooth road with no dust at the cheapest cost.

Giving figures as a basis, the old roads, prior to the automobile, with city, suburban and rural travel, cost three cents per square yard per annum. Increased cost of material, labor, population and wear has increased this amount to from five to six cents, application of oil, one cent; improved asphaltum or other binder surfacing, two or three inches thick, costs on an average one dollar per yard. This must last twelve years to equal the other practice and must also keep a smooth surface, which many of them do not.

Another trouble is that with the use of improved surfaces costing one dollar per yard, the appropriation is so cut into that much needed repairs are entirely neglected, causing much dissatisfaction.

Distributing and Mixing Machinery for Construction and Maintenance of Bituminous Pavements and Surfaces.

By Arthur H. Blanchard, M. Am. Soc. C. E., Professor of Highway Engineering, Columbia University, New York City.

THE increase in the use of bituminous materials in the United States during the past four years has been phenomenal. For instance the State Highway Departments of Maine, Maryland, Massachusetts, New Hampshire, New Jersey, Pennsylvania and Rhode Island in 1908 used bituminous materials in the construction and maintenance of 416,000 sq. yds. of road surface while in 1910 the total was 18,244,000 sq. yds.

With the increase in the use of bituminous materials in the construction and maintenance of highways there has arisen the demand for economical and efficient machinery. The development of machinery in Europe has been much more rapid than in the United States as it was practically ten years ago that Dr. Guglielminetti started the effective campaign against dust at Monaco, while American engineers have only used bituminous materials in country road construction for about five years.

The fact that a large percentage of the work both in the United States and in Europe has been done by surface treatment or penetration methods has led to a greater development of distributing machines than of mixing machines. The relative advantages of the different methods of construction and maintenance will not be discussed in this article, but it is of interest to note that the use of the mixing method is increasing, due to the introduction of machinery with which this class of bituminous pavement can be constructed both economically and efficiently.

Distribution of bituminous materials by hand methods for both superficial treatments and penetration work is generally accomplished as follows: by pouring pots; by hose attached to some type of pressure tank; by small kettles fixed to wheels and pushed by hand; by brooms which are supplied with bituminous material through a hose which is connected with a tank.

Steel tank wagons of 600 gallons capacity equipped with steam coils or other means of heating the material and with appropriate fittings so that pressure may be obtained within the tank have been used to some extent in the United States for distributing tar and tar-asphalt compounds in constructing roads by the penetration method. A flexible hose with a nozzle is attached to the outlet valve of the tank by means of which the material is applied to the road. The tanks are hauled by a steam roller which not only supplies steam for heating the material in the tank, but also furnishes the steam for the pressure. The pressure is obtained by admitting the steam into the tank above the bituminous material, the latter being forced out by the pressure of the steam between the material and the top of the tank. By an arrangement of the piping system, means are provided at the outlet valve of the tank so that the steam can be admitted to either side of the valve. The valve or the hose can be easily and thoroughly cleaned out before the distribution of the bituminous material is commenced by simply allowing hot steam to pass through the same. Several types of nozzles at the hose end have been tried. One form is the round pipe with the outlet flattened to a slot. This nozzle does not throw as good a spray as a special nozzle, cast in such a form that the material is given a twisting motion just before it leaves the nozzle, resulting in a cone shaped spray. Two men are generally used with this machine besides the man on the roller. One man is at the nozzle end of the hose and the other clasps the hose about midway of its length, and drags is around as the nozzle man distributes the material.

The European machines of this type, used principally for superficial treatments, are of much smaller capacity, and are either drawn by hand or by horses. The capacities of the machines range from 50 to 320 gallons. Essentially these machines consist of a tank for holding the material, the tanks being heated by direct fire, a semi-rotary pump with a length of suction hose attached to the tank for the purpose of filling the latter and another pump attached to the tank by which it is possible to generate a pressure between the pump and the nozzle. The material is pumped from the tank through a length of flexible hose to the outlet end of which is fixed an iron pipe fitted with one or more nozzles. The nozzle is of such a form that the material is thrown in a fine cone shaped spray. When the machines are equipped with five or six nozzles they are so arranged that a two foot width of surface can be covered at a time, the nozzles being fixed to a pipe on two small wheels. When one or two nozzles are used, the distribution is effected by passing them over the road surface, the pipe being held up by the

I. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
Studebaker Hot Road Oiler.

II. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
A. T. C. Distributer.

men. Both the pump for filling and for pressure are operated by hand, hence it takes at least two men to operate this type of machine, one to run the pressure pump while the other manipulates the hose.

Distributers drawn by hand, consisting of small kettles mounted on wheels, are usually of the gravity flow type, the "Eldus" being typical of this class of machine.

The fourth method mentioned is accomplished by means of a special form of broom known as Wathman's Reservoir Broom and is adaptable only for superficial treatments. This apparatus comprises a kettle in which the material is heated and to which are fitted two lines of flexible hose, each of which is attached to the head of a hand push broom. The tar flows through this flexible hose into the head of the broom and is thence swept into the road by the men operating the brooms. One man pulls the tar kettle, two work the brushes behind the kettle and a fourth man supplies the kettle with fresh material.

Distributer machines may be readily divided into two general classes, that is, the gravity flow type and the pressure type. Watering carts were first used in the United States for distributing the light oils and tars for suppressing the dust. The ordinary spray attachments on the carts were not very satisfactory for distributing this class of material. Attention was then directed to modifying the distributing device, still using the wooden tank wagon. Practically all of the modifications consisted in substituting for the improved type of water sprinklers one or more horizontal pipes pierced with small holes. These pipes were attached to the outlet pipe of the tank and were placed parallel to the back axle at the rear of the tank. The pipes were usually about the same length as the gauge of the rear wheels. The material flowed through these pipes in small vertical streams onto the road surface. In distributing small quantities the road surface would not be entirely covered with the material but the streams would be separated by the distance between the holes in the distributing pipes. Traffic would work the material around on the road surface so that in the course of time a fairly satisfactory result might be obtained. The materials were of such a consistency that they could be applied cold. Larger quantities of the material could be distributed by bringing into use at the same time more of the horizontal distributing pipes. This type of apparatus is used to some extent at the present time in the United States.

III. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
Perfection Distributer and Heater.

The general practice in Europe in using machines of this type is to follow the distribution by brushing the material into the road. This is either done by hand

brooming or by brooms which are attached directly behind the distributer. The brooms are either of the drag or rotary type. The machines are made to be drawn by hand or by horse. They consist essentially of some form of iron tank having capacities of from 50 to 320 gallons, mounted on wheels, with the distributing attachment at the rear. This attachment consists of horizontal pipes pierced with holes similar to the arrangement described above. The purpose of the brushing is to distribute the material evenly over the road surface and, in applying small quantities of material by a gravity flow machine, it is the only way

IV. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
Hedeline and Voisembert Pressure Distributer.

of accomplishing this object. Most of these European machines of the larger sizes are provided with fire boxes for heating the material and with semi-rotary pumps for filling the tanks. The smallest sizes are found to be very advantageous in repair work. The Lassailly and Weeks machines are illustrative of this type of distributer.

As the demand developed for a heavier binder, both for surface treatment and penetration work, machines especially designed for distributing these materials began to appear. The market at the present time in this country is supplied with so many different types, each one of which is claimed to be "the distributer," that a thorough investigation is an essential preceding the acquisition of machines for various classes of work. Among the American distributers of the gravity flow tyje may be mentioned the following: the Studebaker improved road oiler; the Studebaker hot oil machine; the A. T. C. distributer; the Topping oil sprinkler and distributer; the Perfection distributer and heater; the Perfection distributer; the Good Roads Improvement Company distributer.

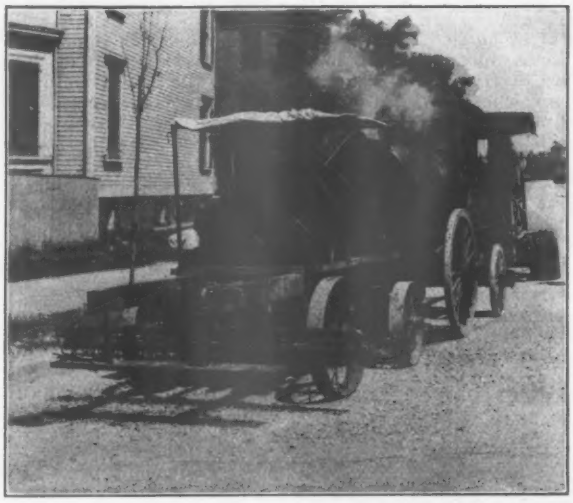
The Studebaker improved road oiler consists of a steel tank wagon of at least 400 gallons capacity to the back of which are fitted three horizontal distributing pipes, which are parallel and are fed by two large pipes from the tank. Levers are provided for the control of the outflow and are operated by a man on a seat which extends out beyond the pipes. The material flows out of holes bored in the horizontal distributing pipes. This machine is generally drawn by two horses.

The Studebaker hot oil machine, Plate I, is a 500-gallon steel tank with practically the same type of distributing apparatus as is used on the Studebaker improved road oiler. To obtain uniform distribution a splash board attachment has been provided. The tank is provided with tubes placed vertically throughout the interior, through which heat is conveyed to the material within the tank. The heat is obtained by means of oil burners placed in a fire box which is the full size of the bottom of the tank.

The A. T. C. distributer, Plate II, is a small trough mounted on two wheels which is intended to be attached to the rear and underneath the outlet valve of any form of tank wagon. Leading from the trough to a horizontal distributing pipe near the ground are three vertical pipes. The horizontal pipe is fitted with nipples through which the material flows onto a splash board and thence falls to the road surface in a continuous sheet. This machine requires one man to manipulate the distributer.

The Topping oil sprinkler and distributer is a distributing device designed to be attached to any form of tank wagon. The horizontal distributing pipe is made up of two separate sheet iron cylinders fed from the cart by two pipes in the form of an inverted V. The material flows into these cylinders, and by means of levers, the outlets of the cylinders are so controlled that a sheet of the material can be spread upon the road. The levers are controlled by a man who sits on a seat over the distributer.

The Perfection distributer and heater, Plate III, consists of a portable 350-gallon tank, at the rear end of which is fixed the distributing apparatus. The material flows through two pipes into a pipe with rectangular cross-section, which extends



V. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
Ward Pressure Distributer.

VI. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
Pillsbury Pressure Distributer.

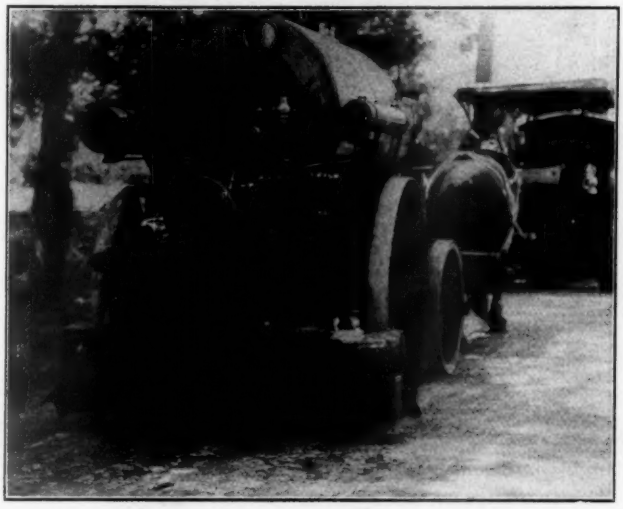
the full width of the tank, and from this compartment through a V shaped trough onto the road surface. In this manner the material is applied to the road in a continuous and unbroken sheet. The distributing apparatus is provided with levers and valves for the control of the flow of the material and is operated by one man on a seat over the distributer. This machine may be either drawn by horse or by a steam roller. The tank has a fire box extending underneath the tank for its full length and is heated by means of a direct fire. The distributing apparatus is also cased in and connected with the fire box so that, if it is desired, heat may be passed around all of the pipes even while the machine is distributing the bituminous material.

The Perfection distributer has exactly the same form of heater, but it is not cased in and is attached to a 600-gallon cylindrical tank wagon. This tank is provided with a small fire box for the purpose of heating the material in the tank. The tank wagon is horse drawn.

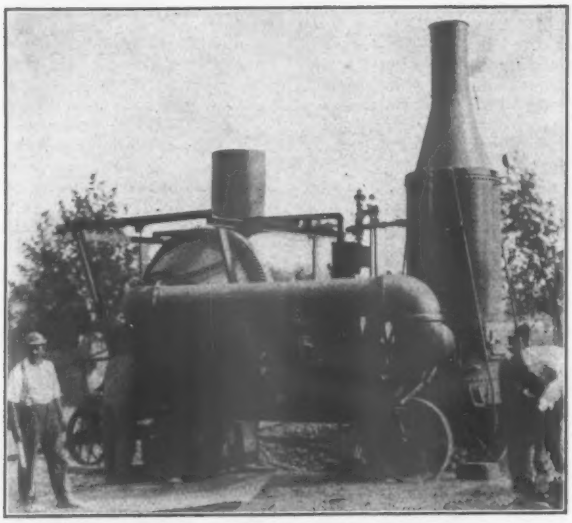
The Good Roads Improvement Company distributer is similar to the Topping in that it is designed to be attached to any form of tank wagon. The material flows through two pipes connected with the bottom of the tank wagon to the horizontal distributing pipe. The amount of the material distributed is controlled by the man operating the levers who rides on a seat over the distributer. This same company has also designed a special form of heating apparatus consisting of kerosene oil burners. It is so arranged that it can be attached to any form of steel tank wagon without any riveting being required.

One of the most famous pressure machines in Europe is known as the Aitken distributer. This machine consists of a tank at the rear end of which is fixed a small cylindrical pressure tank connected with the air and tar pump. The quantity of air and tar admitted to the compression tank can be easily regulated. The material is sprayed on the road through a horizontal distributing pipe fitted with spraying nipples. Where large areas have been covered by superficial treatments, this machine has given excellent results in England. The tanks are provided with means of heating the bituminous material. There are other makes of pressure distributers which omit the compression tank, the material being pumped direct from the tank by a force pump situated between the tank and the nozzles. The Hedeline et Voisembert pressure distributer, Plate IV, is a machine of this type.

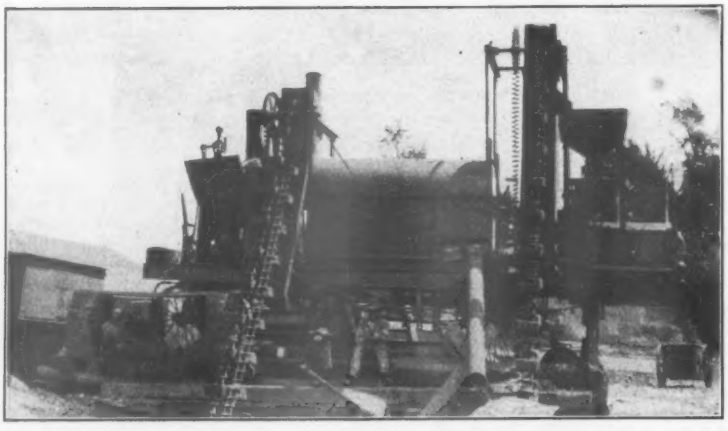
Several types of pressure machines have been invented in the United States, the most widely known being the Ward distributer, the Johnson distributer, the Pillsbury distributer, the H. P. spreader and the Standard Oil Company's distributers. The distributing devices of all of these machines are alike in having horizontal pipes fitted with nozzles. The ma-



VII. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
Gasoline Engine Distributer of Standard Oil Co.



VIII. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
Smith Hot Mixer.



IX. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
Iroquois Self-Propelling Asphalt Concrete Mixing Plant.

chines differ somewhat in the way the pressure is obtained and applied.

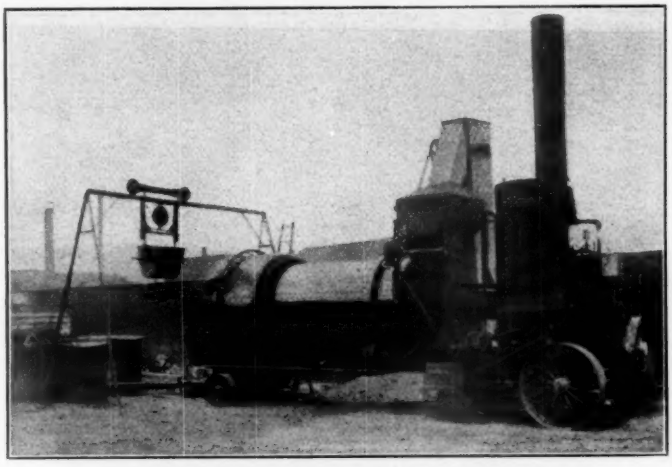
The Ward distributer, Plate V, employs a gasoline engine and pump which is either attached directly to the tank or placed on a separate carriage. The pump is placed between the tank and the distributing pipes and draws the material from the tank and forces it through the nozzles at a pressure of about 30 to 50 pounds.

The Johnston distributer is separate from the tank wagon and consists of a steam pump mounted, together with the distributing pipes, upon a truck. For its operation it requires, of course, a steam roller, which furnishes the steam for the pump, the roller drawing the tank wagon and the distributer. The truck to which the pump and distributer are attached has a steering wheel so that the man operating the distributer may guide it independently of the roller or tank wagon. The H. P. spreader is similar in construction and in method of operation to the Johnston distributer.

The Pillsbury distributer, Plate VI, is attached to a specially designed steel tank wagon capable of containing steam under pressure. The tank wagon is drawn by a steam roller, the boiler of which is connected with the tank wagon, furnishing pressure on the bituminous material in a manner similar to that described for the pressure tank wagons and hose distributers.

The Standard Oil Company have used a distributer, Plate VII, which is similar to the Ward distributer. In this machine the pressure is obtained by means of a gasoline engine and pump attached to the rear of the tank wagon. In another type of machine the pump is run by a sprocket drive from the rear wheel. The Standard Oil Company have also used to some extent a large automobile truck fitted with a tank for holding bituminous material and a pump driven by the engine for developing the requisite pressure. None of these machines have means of heating the bituminous material.

For many years in connection with the sheet asphalt paving industry mixing plants have been in use. A complete plant of this sort consists of a sand dryer and storage bin, kettles for melting bituminous material, and a mixer capable of mixing the sand and bituminous material together, all suitably arranged so that the operations follow one another in such a manner that none of the ingredients of the mixture have to be handled by hand from the time they are placed in the receiving end of the machine until they leave the outlet end. Such plants are now placed permanently on flat cars as one or two car portable plants. During transportation the plant is housed and when the car is drawn up on a siding the machinery may be rapidly prepared for work. The mixing device of this type of plant consists of a semi-cylindrical trough for holding the materials to be mixed together. A series of paddle wheels revolve on a horizontal axle which is fixed at either end within the trough. These pad-



X. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
Warren's Portable Asphalt and Repair Plant.

dles agitate the ingredients and thus produce the mix.

To meet the demand for a mixing plant with which various types of mineral aggregates can be economically mixed with bituminous material, several machines have been designed in this country. The requirements of engineers vary to a considerable extent due to the different kinds of aggregate employed; that is, in some cases, one size crusher run stone is used; again combinations of broken stone and sand are employed; while in many instances a carefully graded aggregate is specified. The following machines have all been used in connection with the construction of bituminous pavements of the above types: the Link-Belt portable asphalt paving machine; the Smith hot mixer; the Guelich portable asphalt plant; the Iroquois self-propelling asphalt concrete mixing plant; the Warren Brothers' Company portable mixing plant.

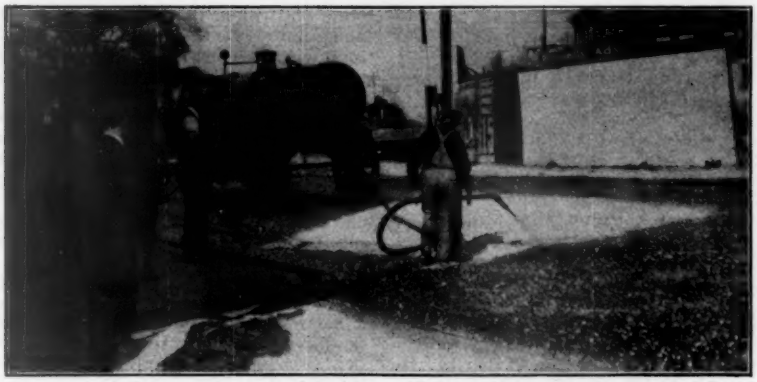
The Link-Belt machine is made in two sizes and mounted on four wheels for transportation purposes. The large machine is about 27 feet long and weighs approximately 17 tons. Practically all of the mechanism is housed in. It consists of melting kettles, a dryer, a dust blower and a mixer. The material is shovelled into one end of the machine, passes through the dryer and thence into the mixer, where it is mixed with the bituminous materials. The power for operating the machine is obtained by belting it to a road roller or a traction engine. The heat for the dryer, the melting kettles, etc., is obtained by means of fire boxes underneath the machine, in which coal is burned as fuel, the hot air passing around the various parts of the machine.

The Guelich mixing machine is a batch mixing machine of a somewhat similar type. It consists of small storage hoppers for the different materials, a dryer and a mixer. The mixing device in this machine is somewhat unique in that it is a cylinder which revolves around fixed paddles. This machine is furnished with a small engine capable of developing the requisite power for running the machine and has a fire box by means of which heat is obtained for keeping the dryer and the mixer hot. It is mounted on four wheels and can be readily transported from place to place by a steam roller or other tractor.

The Smith mixer, Plate VIII, is an ordinary Smith cement concrete mixer modified to meet the demands of the work. The mixer, boiler and engine are all mounted on a four wheel truck. The heat is passed into the mixer by means of a large iron pipe, which runs from the fire box to the outlet end of the mixer. A blower is attached to the fire box so that the hot gases can be forced through the pipe and mixer. An automatic loading skip run by the same engine which runs

The Iroquois plant, Plate IX, is mounted on a four wheel truck and consists of an engine and boiler, a dryer and mixer. The stone is raised by means of a chain elevator, passed through the dryer and out to the ground again where it is raised by another chain elevator to hoppers placed over the mixer. The mixer itself is heated by a small steam jacket underneath the bottom. The mixer is of the same type

XI. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
American Tar Company's Tar Coating Machine.



XII. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
Barrett Mfg. Co.'s Hose Pressure Distributer.

XIII. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
Hand Distributer with Perfection Pouring Can.

as described under asphalt paving plants.

The plant connected with the Warren Brothers' portable mixing machine, Plate X, consists of a boiler, oil burning apparatus, hoppers, elevators, dryer and cylindrical mixer. In operation the measured aggregate is deposited in elevators which carry it to a storage bin from which it flows to a dryer and after a varying interval is dumped into the mixer. The bituminous material is introduced into the mixer above the discharge outlet.

Two machines which have been built in Europe for a similar purpose are the Ransome-ver Mehr and the Aeberli. The Ransome-ver Mehr is simply a mixing drum with open top and circular bottom provided with two axles which are fitted with steel arms constructed on the hit or miss principle. If desired the ends of the drum can be steam jacketed. The mixer discharges through the bottom of the mixing drum. The machine is mounted on a four wheel truck. By means of the Aeberli

machine the broken stone is dried, cleaned and finally passed through a bath of cold tar.

A tar coating machine that has been used in this country to some extent is that of the American Tar Company. This machine, Plate XI, is a long trough with an incline at each end, equipped with a fire box and mounted on wheels. Under the middle portion of the trough three hot air pipes pass through the bituminous material. The cold material is introduced in either of two jackets on the sides of the trough, which jackets form a continuation of the compartments beneath the trough. The hot material rises in the jackets and passes into the trough through holes in the inside walls of the jackets. Cold stone is placed on one incline and raked there into the hot bituminous material, and then onto the other incline under which there is a hot air bath, by the aid of which superfluous material is drained off.

In this paper no attempt has been made to give the limits of quantities of various materials which can be applied by any of the different distributers or the nature of the output of the various mixing machines. The efficiency of distributing and mixing machinery is a function of many variables, among which may be mentioned; the kind of bituminous material and mineral aggregate used, climatic conditions, the type of construction or maintenance employed, the amount of work to be accomplished, plant arrangement and labor organizations.

Brick Road Construction About Cleveland and Buffalo.

Editorial Correspondence.

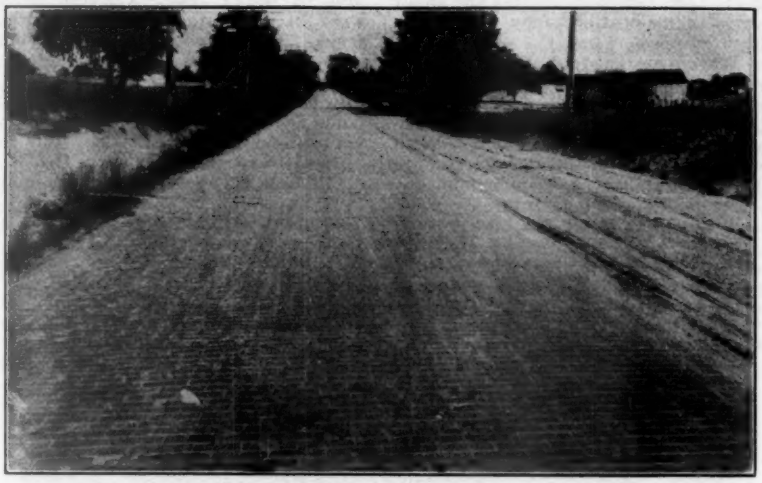
THE use of brick in country road construction, while not limited to the northern portions of Ohio and New York, has been brought to its highest excellence in that region. The vicinities of Cleveland and Buffalo have been improved by the building of brick roads, to a degree that it is possible to travel for miles in the neighborhood of Cleveland and to enter Buffalo by most of the main thoroughfares, upon roads which are surfaced with brick. Cuyahoga county, Ohio, in which Cleveland is located, has over three hundred miles of these brick roads. The county possesses conditions which present about every problem of road construction. The soil is of a sticky yellow clay with occasional outcropping of rock. The variety in topography is about as marked as is the soil, some of the roads being so level that the drainage is the most serious problem to contend with; while others are so rough and broken that, in order to procure a feasible grade line, the cost of excavation becomes an important consideration.

By reason of the fact that the city of Cleveland was situated within the county, it became possible to build a form of road which was high in first cost; and it also made necessary the construction of permanent roads to allow of the heavy hauling into and out of the city. The Ohio road law of 1908 provided the means of obtaining substantial roads in Cuyahoga county, and the proximity of excellent paving brick led to the adoption of this material.

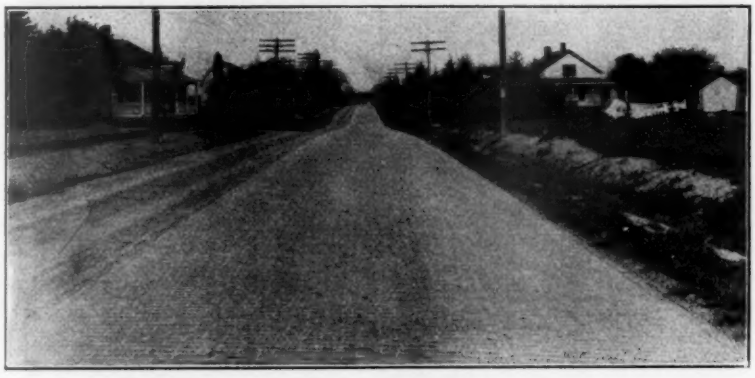
The old style of 8-foot brick pavement, with its base of sand or gravel, had its trial in the vicinity of Cleveland. This was followed by the 14-foot standard road with a slag or crushed stone base and sand cushion; and this in turn was superseded by the grout-filled pavement laid on a concrete base. The first road built according to this standard was laid in 1905, in the village of Brooklyn. A 4-inch base was at that time deemed sufficient.

The most recent form of construction, and one which has reached a degree of excellence superior to any brick road construction of the present time, is according to the National Paving Brick Manufacturers' Association specifications. This construction provides for a 14-foot roadway, concrete curbs, a 4-inch concrete base, a 2-inch sand cushion and a "one-to-one" cement grout filler. The drainage is provided for by giving the whole pavement a pitch to the outer curb and a slight crown.

A number of roads have been constructed according to this general standard. A notable instance of this more recent construction is the Dunham road shown in an accompanying photograph. This road was built about five years ago, and at the present time is in excellent condition. One criticism, or rather apprehension, which has been expressed, regards the construction of permanent brick roads with concrete curbs, directly along a dirt road. It was stated that the traffic in passing from one road to the other would cause a rut to form along the curb, which in turn would be worn and



DURHAM ROAD, CUYAHOGA COUNTY, OHIO.
Laid Five Years Ago on a Concrete Base.



NORTH RIDGE ROAD. CUYAHOGA COUNTY, OHIO.
Laid Five Years Ago on a Broken Stone Base.

broken, and in time work away from the brick surface. That this is by no means the case is noted from the photographs given herewith. There are also a number of examples of roads, some of which are eight or ten years old. These latter, most of which were laid on a stone or slag base, are in very excellent condition.

It has been noted in these pages and in other instances where comment has been made on the Cuyahoga county roads that there were a number of cases in which longitudinal cracks had formed in the center of the brick roads. At the time of the official inspection of these roads in 1910, by a committee of municipal officials, it was stated that in all probability these cracks would deepen and chip along the edges, causing a rut to form along the center of the roadway. This fear has proven, up to the present time, to have been groundless. The longitudinal cracks, except for a few isolated cases where soft brick have been used, are not more pronounced than at the time of the inspection. In a few cases the local officials have caused the cracks to be filled with some sort of pitch or asphalt filler; and in every instance of this kind the chipping of the edges has been as marked as in those where there was no attempt at repair. Where cement

grout has been carefully applied the small amount of deterioration along the cracks has been stopped.

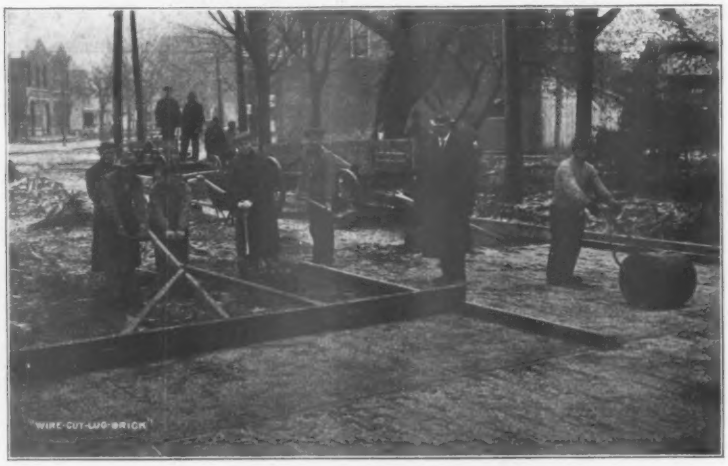
The reason assigned by Will P. Blair, secretary of the National Paving Brick Manufacturers' Association, for the formation of these longitudinal cracks is imperfect drainage in the subgrade. With a view to correcting the defects due to this factor the following recommendations have been made: "For draining the roadbed in most soils a small tile, laid parallel with the curb with 'T' outlets at intervals of every ten feet, will answer. If, however, the soil is of such character that the water by capillary attraction fills to the uttermost then, to avoid frost action incident, it is necessary to run two lines of tile along the curb lines, with diagonal drains placed at frequent intervals and 'staggered'." Mr. Blair also recommends the use of one-inch expansion joints along each curb, wider joints being used as the pavement width is increased.

The more recently constructed Cuyahoga county roads, as well as many of the older roads, are entirely free from any defect; even the longitudinal center cracks noted above. The proportion of poor roads among the older brick highways in the vicinity of Cleveland is very small, and among those constructed under the new standards there are no examples of poor construction.

In the vicinity of Buffalo the brick road has been almost universally adopted by the state road department. It is stated in this connection that the immense volume of heavy traffic and the combined wear of the automobiles and the heavy trucks and wagons demand a smooth, permanent roadway. These factors, connected with the fact that the city of Buffalo pays the larger portion of the taxes made necessary by the cost of these roads, led to the adoption of brick in this region.

The road construction in the vicinity of Buffalo has been in charge of W. C. Perkins, resident engineer of the New York State Highway Department, and a force of twelve assistants. To the careful and efficient supervision of the engineering department may be ascribed the excellent results obtained on the roads in question.

One example of the Buffalo brick road work is the Williamsville road, of which a number of photographs are here shown. This road was constructed late in the fall of 1910; in fact, some of the work was done during freezing weather; but due to careful and efficient attention of the engineer in charge no bad effects resulted. This stretch of road at the present time is in excellent condition. It is smooth with even joints, which are filled flush to the surface but not "flooded"; and except for a few instances is free from the center cracks referred to in connection with the Cleveland roads. The few instances of center cracks have been carefully dealt with, and it is probable that no further trouble will result on that score. In speaking of the tendency towards longitudinal cracks in the center of the pavement, Mr. Perkins stated his



THE BUFFALO-WILLIAMSVILLE ROAD.
Leveling the Sand Cushion.

belief that the trouble was due to the heaving action of frost in the ground, and in support of his statement gave some instances of undoubted frost action. He suggests as a possible remedy the construction of the concrete base with a flat bottom and a curved top conforming to the crown of the pavement. In this way the line of weakness; i. e., the top of the arch which fails under upward pressure will be eliminated.

In the Williamsville, as well as in a number of other New York brick roads, "wire-cut-lug" brick have been used. These brick are as their name indicates cut to a regular form by means of wires and are not repressed. They are very regular in size and shape, have square edges, are imbedded firmly in the filler and appear to give a more even surface and straighter joints than do the repressed brick. It was noted on one road, which was being rolled preliminary to applying the grout, that the roller had caused a spalling or flaking of the edges of the newly-laid brick. What was the cause of this, the writer is not prepared at the present time to venture.

The specifications under which the New York roads are being laid differ in some respects from those in use in Ohio. In the case of the roads in the vicinity of

THE BUFFALO-WILLIAMSVILLE ROAD.
Rolling—Preliminary to Applying the Grout.

THE BUFFALO-WILLIAMSVILLE ROAD.
The Completed Road Ready for Expansion Joints.

THE BUFFALO-WILLIAMSVILLE ROAD.
Applying the Grout According to the N. B. M. A. Specifications.

Buffalo, the pavement is laid with the two curbs at the same elevation, and a crown of one-fourth-inch to the foot is provided. A 1½-inch expansion joint is allowed at each curb in the case of a 16-foot roadway, which is considered standard. The sand cushion provided is only 1½ inches instead of 2 inches, as in the case of the Cuyahoga county roads. The reason given for this is that less rolling is required; and as one engineer on the New York work stated, "We make up the difference by raising the low ones and bedding the high ones."

One practice which is almost universally followed on the New York work and which is condemned in the National Paving Brick Manufacturers' specifications is that shown in the accompanying photograph; namely, that of "dumping" the grout box instead of scooping the mixture over the pavement. The engineers in charge state that the results obtained are as good as if the slower method was used. It is doubtful, however, if this is the case, as it seemed that the flood of material as it was dumped from the box caused an unevenness in the amount of the grout which found its way into the joints; and it is probable that some joints were imperfectly filled. It was noted, also, that the pavements of which the joints were filled by dumping the boxes had an excess of filler on the surface of the brick, a fact which was not true of the pavements which were treated in the other manner. The second grout coat is added by dumping the grout box and brushing the material into the joints with rubber "squeegees."

MAIN STREET ROAD, BUFFALO, N. Y.
Applying Grout by the Incorrect Dumping Method.

EDITORIAL COMMENT

The American Association for Highway Improvement.
Central Utilities Commission and Home Rule.
Standardizing Specifications.

THE AMERICAN SOCIETY FOR HIGHWAY IMPROVEMENT.

The first convention of this new society, not yet a year old, will be held in Richmond, Va., November 20 to 25, 1911. Some idea of the program has already been given in MUNICIPAL ENGINEERING, and further details will be found in the news departments this month.

This is the first society devoting itself to highway improvement which has stated its intention to keep itself free from entangling business, personal and political alliances, and thus far has fulfilled its promises. All sides of the road problem will be presented on the different days of the convention, and men of all shades of interest in the subject will find the convention well worth the trouble and expense of the trip.

President's day with an address by President Taft has other addresses by prominent men interested in the good roads problem from its effect on the development of the country. The engineers have a day for the discussion of the technical problems; the road users have their day, and so on through the list of classes of men devoting themselves to good roads.

The automobilists are preparing for automobile trips from all directions to Richmond and will be there in full force.

This association is affiliating with itself the state, local and district good roads associations and clubs, and is preparing for a general concerted forward movement all along the line. Field agents are busy answering the calls for help in developing local sentiment and in organizing local clubs and associations. The association has the benefit of close touch with the Office of Public Roads of the United States Department of Agriculture, and the two organizations are co-operating in every way possible. The president of the association is Logan Waller Page, who is in charge of the Office of Public Roads. J. E. Pennybacker, Jr., Colorado Building, Washington, D. C., is the secretary. Either will send full information about the association on request.

CENTRAL UTILITIES COMMISSION AND HOME RULE.

In a paper before the Madison Literary Society, Mr. B. H. Meyer, recently chairman of the Wisconsin Railroad Commission, discusses the effect of the regulation of public utilities by state commissions upon the principle of home rule in cities. In most states of the Union, if not in all, the discussion is largely academic, for there is no more real home rule in the average American city than a state legislature, proud of its power and anxious to exercise it, is willing to allow temporarily, and largely as a cat plays with a mouse. But the desire for home rule in cities is developing at the same time that the advantages of expert disinterested supervision of the operation of the public service industries is being demonstrated by such efficient bodies as the Wisconsin State Railroad Commission. It is therefore a timely question as to whether the one advance will conflict with the other.

Mr. Meyer's paper is not a direct attack upon this question, but is largely a demonstration of the overwhelming advantage of taking the supervision of the public service utility out of the hands of the ignorant, changing personnel of the ordinary city council and putting it into the hands of a few experts who spend all their time upon the many problems arising and so can give satisfaction to both server and served. He carries the question into the higher field of inter-state relations, and

shows that the problem is the same though the terms in which it is stated are somewhat different and the method of solution is materially different.

In the case of state public service commissions, the speaker showed that the real features of home rule were not interfered with by the state control of the operation of the utilities under their control. The Wisconsin law expressly gives to every city council the power to determine by contract or otherwise the quality and character of service, the terms and conditions of the company's occupation of public areas, the extension of service, etc., subject only to such review by the state commission as will insure that the ignorance of the city officials has not been taken advantage of by the expert knowledge and business ability of the managers of the company.

Mr. Meyer might well have emphasized the fact that the city is primarily a business corporation and not a political organization. It is organized to do for its citizens what they cannot do for themselves, or what the corporation can do for them better and cheaper than they can do for themselves.

The home rule principle applies to the determination by the citizens, directly or through their representatives, the mayor and councilmen, of what they desire to do. It is evident that temporary officials, such as councilmen, cannot be expert enough to control the public service corporations, whether under private or public ownership, and it is an open secret that they are seldom able to select expert officials to operate them under public ownership, nor to keep experts when they happen to find them. It will doubtless turn out to be true, especially in the smaller cities and towns, that even under a business administration, technical matters will be mismanaged because sufficient compensation cannot be paid to secure competent superintendents, or for other reasons. All these things point to the expert state commission as supervisor of the technical construction, operation and financial plans and methods, but at the same time the latter show themselves to be details of operation which are quite aside from the real "home rule" issue, and may be safely handed over to state commission supervision without loss of any privilege which the future application of the principle of municipal home rule may confer upon the municipality.

The reason for extending federal control over inter-state public service utilities is not the same in all respects and the reasoning concerning it must be different. Those who are interested in this phase of the subject are referred to Mr. Meyer's paper, which is published in *The American Political Science Review*, under the title "Central Utilities Commissions and Home Rule."

STANDARDIZING SPECIFICATIONS.

After some years the idea that standard specifications for various kinds of construction work can be formulated has become popular. For a long time about the only attempt at such a formulation was that of the water works associations regarding water pipe, but of late years the process has been extended to other materials and methods of construction, the most prominent development being the formation of an association for the sole purpose of standardizing paving specifications. Immediately preceding the formation of this association the American Society of Municipal Improvement appointed a committee on standard specifications, which has since become one of its standing committees and made a considerable contribution to the subject at the recent Grand Rapids convention of the society. The difference in the methods followed by the committees of the two organizations suggests a discussion of the principles on which such work should be based in order to secure the most satisfactory results, from which it is possible that criteria may be developed by which to measure the propriety of these methods.

A standard specification cannot be expected to cover all the peculiarities of local conditions and must omit such items as are strictly local in their bearing, as well as permit such modifications of the provisions actually adopted as local conditions demand.

Specifications are of two general classes, those regarding materials and

those regarding methods of preparing for and using the materials. The specifications regarding general matters are more strictly appurtenant to the contract for the work, although they usually touch the more strictly construction matters close enough to justify their incorporation in the specifications. Being largely matters of law and custom they depend for form and extent to a large degree upon the local municipal laws and ordinances, and so they have been very properly omitted from the discussion of standard specifications.

As regards materials the general specifications may well set standards for those to be used in the best forms of construction, which should be approached as nearly as possible in each locality, due attention being paid to the questions of cost and availability. It may be more economical for a certain locality to use a poorer class of materials and make the necessary repairs and replacements than to use the best materials which, because of inaccessibility or other reason, are so expensive that their ultimate cost as well as the first cost are greater than for the more available materials. These matters cannot be determined by the standard specifications, and the lines laid down by them should not be held so tight in such localities as to defeat one of the real purposes of the specifications; viz., to produce a structure which shall be not alone the best and of the best materials, but the most economical as well. If the standard specifications for materials and methods of construction are followed, successful structures should be secured. If the terms are modified the structures will be less successful from the standpoint of excellence of construction, but may be more successful from the standpoint of economy. It seems to be generally accepted that a standard specification cannot take account of these modifications, which are sometimes so necessary, and so can include only such materials and processes as are known to produce good results when properly applied. The caution against excessive strictness in applying them in a particular case is all the latitude which can be admitted.

It happens that a single specification does not always include all the materials which are known to produce good structures. Thus there must be specifications for cast iron, steel, wood and other water pipes; vitrified pipe, concrete, brick and other sewers; materials for treating blocks for wood pavements; asphaltic cements; cement and bituminous fillers, etc. Evidently these specifications must be alternate since no one specification will cover all the various kinds of material for the same use. A specification which omits any material which can and does produce good results fails to be a complete standard to that extent and is in so far open to the accusation of favoritism of one sort or another. The problem before the committee on standard specifications is to provide ample specifications which will admit all the good materials at the same time that it excludes those which cannot produce good results, except in special cases of unusually favorable conditions. New materials are entering the field every year, which must be covered. Their promoters should not be too seriously offended if they are required to show their merits before they are admitted.

Methods and processes used in preparing materials for use come very naturally under the specifications for materials. Those for using the prepared materials are likely to be largely local and special in their nature. The former are included in many standard specifications, although there is a commendable tendency to make the specifications cover the results of the treatment of the materials rather than the methods. The latter are included where special care is required in their application.

The Association for Standardizing Paving Specifications and the American Society of Municipal Improvements are working along parallel lines with many persons, members of like committees in both organizations, so that they are approximating uniformity in their recommendations. Both of them have succeeded in adopting the larger part of their standards for various pavements, and it is probable that the former organization at its January meeting in New Orleans will complete its work upon the fundamentals

of the specifications and that the latter society will come to the same stage at its next convention.

This does not mean that the specifications can then be considered as crystallized and complete, ready for use for any considerable length of time. Few specifications are as stable as that for cast iron water pipe has become, for example, and some are as yet in the formative state so far as many of their details are concerned. Then there are the new materials and processes which are added each year. The American Society of Municipal Improvements provides for these unfinished matters and for the new materials by making its committee on standard specifications a standing committee which will present each year such reports from its sub-committees as are required to keep the specifications up to date.

The process by which these questions are formulated into specifications is of much importance and the following program is presented as one which should secure full consideration of all the component parts of any proposed specification from all points of view. It would seem to be one which will give ample opportunity for all interests to have full hearing and for the adoption of such new specifications and modifications of old ones as are shown to be good, and to safeguard sufficiently the admission of materials whose fitness for the use for which they are proposed has not been proved.

In the first place the general committee on standard specifications appointed by the president of the society is made up of five past presidents of the society, and is presumably composed of men fitted to act as a sort of bench of judges upon the specifications brought before them, having mature judgment and more or less thorough and detailed knowledge of all the subjects presented.

Sub-committees are appointed to give detailed consideration to each class of specifications. Each such committee should be composed of experts in the subject referred to them, the nucleus being members of the society but having authority to associate with them more or less closely any engineers, chemists or others expert in the same lines. Each sub-committee should take into consideration all matters in its line which are brought to its attention and should call for the information it may desire and from any available source. After such full and free discussion at meetings or by correspondence, the committee should formulate its report, covering such changes in or additions to the existing adopted standards as seem to it desirable.

The reports of the sub-committees are, according to program, to be presented on the day before the annual convention at a meeting of the general committee. At this meeting each proposed specification will be discussed by the sub-committee presenting it, by the general committee, and by members of other sub-committees and others interested who may be present. The specification as finally formulated by the sub-committee and approved by the general committee is then passed to the consideration of the society. In this way the society receives the work of the experts in each line of work for which specifications are presented as it is reviewed by the general committee.

The society as a whole then has an opportunity to discuss the specifications and to adopt them or return them for further consideration. According to a recent change in the constitution, persons not active members of the association cannot join in this discussion without the permission of the convention.

Persons having particular interest in any proposed specification thus have an opportunity to present their cases to the sub-committee during the year and a further opportunity to join in the discussion before the general committee and before the society, if members, or by special permission, if not, which permission would undoubtedly be given if entitled to consideration.

In this way the engineer, chemist or other expert in the employ of the city, the contractor, the seller of materials, or promoter of methods have the opportunity to present all sides of every case; and if a proper decision is not reached at any convention there is the opportunity to carry the matter through the next year's committee.

THE QUESTION DEPARTMENT

Small Sewage Disposal Plants.

Will you kindly let me know if you have published anything in book form relative to sewage plants for small isolated settlements on the sea coast? MARTIN BROWN. C. E.,
Northport, N. Y.

Such books as Starbuck's "Modern Plumbing Illustrated," ($4), and Raynes's "Domestic Sanitary Engineering and Plumbing," ($3) give instructions on this subject. Also Kinnicut, Winslow and Pratt's "Sewage Disposal," ($3), and Venable's "Methods and Devices for Bacterial Treatment of Sewage" ($3).

Disintegrator for Sewage Solids.

I should esteem it a favor would you publish the following question in your Question Department in order that we may get an answer through MUNICIPAL ENGINEERING:

Have you any knowledge of sewage being treated by a disintegrator for the purpose of breaking all pulverized excreta, paper, rags, etc., volume of sewage (of a weak character) approximately one million gallons daily. The sewerage scheme is established on the separate system, the method of disposal being direct discharge into the tidal estuary into a river, practically into an harbor. The fall ends at a depth of 53 feet below low water mark. J. S. P.,
Chief Health Officer of Tasmania.

Sewage Test with Methylene Blue.

Will you please send me full information on making tests of sewage with methylene blue, also state results that should be obtained I intend to take samples of raw sewage, septic sewage and filtered sewage.
T. P., Indiana, Pa.

The method of using the methylene blue test is described in Kinnicutt, Winslow and Pratt's "Sewage Disposal" ($3). In brief a small amount of methylene blue, dissolved in water, is added to the liquid to be tested, which is put in a tightly stoppered bottle, and the number of days required for the color to be discharged is noted. The time requred for decolorization is about twice as long at 70 degrees temperature as at 98 deg. F. If the color is not discharged in 14 days at 70 deg. F. the liquid may be considered as non-putrescible. Phelps has made a table showing the degree of putrescibility as dependent on the time required to discharge the color. If the reducing time is 20 days, the stability is 99 on a scale of 100; if 10 days, 90; if 7 days, 80; if 4 days, 60; if 3 days, 50; if 1 day, 21.

The test may be applied to the raw sewage, thoroughly mixed, to the effluents from the septic tanks and the filters or to any mixtures of the effluent with various proportions of the water in the stream into which the effluent is discharged.

Mr. Phelps's paper is published in the U. S. Geological Survey's "Water Supply Paper No. 229."

Can Supply Ruddle or Natural Chalk.

In your magazine of May, 1911, on p. 431, Question Department, I note an inquiry for "ruddle." I would like to hear from L. C. H. if he is still desirous of obtaining some of this material.
JNO. R. ROOT, Terre Haute, Ind.

How to Treat Over-Printed Blue Prints.

Will you please tell me what to use when blueprints are burned?
W. H R., Kelso, Wash.

Blueprints which are over-printed may be improved somewhat by washing them with a weak solution of soda, which can be washed off with clean water when the effect has been produced. Can our readers make any suggestions?

Map of Underground Structures.

As I am going to make a map of our city showing location of all underground structures, such as water mains and service connections, sewers and house connections, catch basins, culverts, etc., I would like to ask you what you would call it. Substructural Map of City of Waupaca?
C. W. NELSON, City Engineer,
Waupaca, Wis.

What have our readers to suggest? "Map of the Underground Structures in the Streets of Waupaca" is one title which suggests itself, the lines referred to being all of them in the streets and no substructures outside the streets being shown.

Who Has Authority to Expend City's Money?

What is your opinion concerning the following:

Where a certain improvement was asked of the council, such as building a tile ditch costing say $100, and the improvement was rejected by the council by a vote of 4 to 2. Afterwards the street and alley committee, conniving with the superintendent of streets, purchased the materials and constructed the ditch. Question: Can the street and alley committee authorize a piece of work constructed after the same has been rejected by council by a majority vote? In case council had not passed upon the improvement could street and alley committee authorize the work? What would be the status of the matter if after the work was completed, having previously rejected the improvement, the

council would approve and allow bills for material and work? If the council would approve and allow bills for material and work, would the mayor be justified in refusing to sign voucher or order for same upon the treasurer, assuming that council had previously rejected the improvement, and the street and alley committee had no authority to build said improvement?

B., Mayor, ————, Ill.

Except so far as the statutes restrict the action of the city councils in Illinois, those bodies control the expenditures of the city funds. The council probably has certain by-laws or ordinances defining the duties and the rights of the city officials under it and of the council committees. The council has the right under its rules of procedure to suspend, rescind or modify these regulations or ordinances but must follow its own rules in doing so and also the statutes of the state. If there are no such regulations or ordinances governing a particular case, it is under the control of the council, which can determine what shall be done and how.

The case mentioned seems to be one in which there is some question as to the propriety of the action of the council and of its committee and the city officials and as to the necessity of performing the work in question. There is not sufficient information on which an outsider can base an opinion.

The mayor in Illinois has some control of the situation through his veto and his connection with the public works department. In this case he must apparently determine whether the superintendent of streets overstepped the bounds of his authority in making the purchases and doing the work. This can perhaps be determined from the ordinances and the orders of the council governing that official. He must then determine whether the council committee on streets and alleys has overstepped the bounds of its authority. The form of rejection of the proposed improvement and the necessity of making it have some practical bearing upon the question as to whether the committee and the superintendent have disobeyed orders or have simply proceeded in a legitimate alternative way when the council refused to be responsible for the order to construct the work.

Whether the committee would have the right to order the improvement in absence of authorization by council is also largely a matter of the ordinance or by-law governing the committee. Frequently such committees are granted or tacitly permitted to order improvements costing not to exceed a certain amount which varies from a few dollars up to say $500, within the limits of the statutes. Common limits are $50 and $100 in small cities. One must be familiar with the ordinances of the city in question to give an answer applicable to it.

Approval by the committee of the bills for material and work would ordinarily be approval of the work and would indicate that the committee and superintendent had, in the opinion of the council, acted within their rights under the ordinances; provided, of course, that the approval had not been given through inadvertence or because of intentional or unintentional concealment of the facts in the case.

It would seem to be the mayor's duty, under the statement of facts in the last sentence of the question, to determine whether the council had been misled or had misled itself, and whether the appropriation was a proper one under the circumstances, and he could send the matter back to the council for more definite action by means of a veto. If the bill is just it could probably be collected by suit, notwithstanding the mayor's veto, but he has the right to demand that the council record its approval of the construction, if it has not already done so, and can enforce that demand by means of his veto.

Municipal Asphalt Plants.

Will you kindly furnish me with a list of cities and towns which are operating their own asphalt paving or repair plants?

G. D. CARR, Chicago, Ill.

A list of such plants will be found in MUNICIPAL ENGINEERING, vol. xl, p. 217.

Specifications for Wood Block Paving.

Would you kindly inform us where we would be able to secure a copy of specifications of the American Society of Municipal Improvements for wood paving?

H. B. LAUDERBAUGH, Pittsburgh, Pa.

The American Society of Municipal Improvement has not yet adopted specifications for wooden block paving. The report of the sub-committee on this subject was printed in the proceedings for 1910, but unfortunately the edition of that volume is exhausted. The same report came up for consideration again this year, but was again postponed for further consideration.

Cities Using Reinforced Concrete Poles.

Will you please advise me if you know of any city using reinforced concrete poles for lighting service? Do you know of any objectionable feature that has developed by experience in use of same?

I. A. M., Texaxs City, Tex.

The North Park Commission in Chicago has installed a considerable number of electric light poles made of reinforced concrete. They are used by electric railroads in and about Richmond, Ind., Oklahoma City, Pittsburgh, Chicago and other places. Reinforced concrete telegraph poles have been used to some extent by the Pennsylvania railroad and elsewhere. The use of these poles is extending gradually in every direction.

The only question raised has been that of electrolysis, but no effect of that sort on poles has been reported. Moisture promotes electrolysis and poles do not retain moisture long, especially if care is taken to make the concrete as dense as possible.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited.
Give from your experience for the benefit of others.
Never mind style of composition, the fact is what is wanted.

Another Machine for Mixing Asphalt Pavements.

We note on page No. 211 of your Question Department an inquiry in reference to machine for mixing asphalt paving materials, and we note in your answer that no reference is made to Warren Brothers Company, although we manufacture more asphalt paving plants of all types than any one else in this country.

We are mailing you under separate cover copies of our catalogues of the regular types of asphalt paving plants and also our Portable Asphalt and Repair Plant, which is built particularly for the use in such cases as your inquirer describes.

H. W. ASH,
Boston, Mass.

A photograph of the latest Warren portable asphalt pavement mixer will be found on p. 361 of this number of MUNICIPAL ENGINEERING.

Proposed Method of Treating Blocks for Wooden Pavements.

To the Editor of MUNICIPAL ENGINEERING:

Sir—I offer the following suggestions for treatment of wood paving blocks in the interest of bettering conditions in regard to wooden block pavement.

First. Careful selection of well seasoned lumber, which we must all concede is very important.

Second. Method at the plant, of suitable vacuum and pressure, length of time requirements.

Third. A reduction in the number of pounds of creosote oil per cubic feet of timber, to say minimum of 12 pounds and maximum of 16 pounds.

Fourth. A commercial creosote oil of special grade, 1.04 to 1.07 as maximum; purely a distillate of tar without any attempt of adulteration by adding refined tar or petroleum residuum.

Fifth. A pressure which is sufficient to impregnate the blocks with this lighter gravity oil thoroughly.

Sixth. After the preservative has been forced into the blocks, then waterproof the blocks on all sides by a final dipping treatment into hot asphaltic cement of suitable penetration or consistency.

As creosote is a solvent for asphalt, the blocks should be permitted to dry somewhat before immersion in the hot asphaltic cement. By so doing the dead oil does not act upon the asphaltic cement to any great extent.

This waterproofing on all sides affords a barrier against absorption from and through the concrete base, also provides each block with a thin coating on the sides and ends for taking up any expansion which may be possible, although I believe this will be entirely eliminated. The top coating, after completion of the pavement, could be sanded slightly and the travel would mix this sand with the asphaltic cement and thus form a mastic. This coating would serve to protect as well as prevent slipping of vehicles. In time the coating of mastic would be worn off, and at various periods when needed another surface coating could be applied by brooming, squeegee and sand sprinkled on.

The preservative creosote oil will serve its purpose, viz: to prevent dry rot by its properties, the asphalt coating would seal against evaporation or leaking or being washed out, and prevent the blocks taking up moisture to cause trouble by swelling.

By using the lighter gravity oil we would secure better and more thorough penetration to preserve the wood, perhaps in less time and with less pressure. This would tend to reduce the cost for the oil, also for the treatment, and such saving could be put into the extra cost of the second handling, although such a process could be arranged so that the cost would not be much to give the blocks the waterproofing coating. The additional treatment would give a better block.

This treatment would prevent bleeding and avoid much of the slipperiness now experienced. The waterproofing mastic coat supplied would increase the life of the block against wear and brooming.

By some calculation of the cost of the waterproof coating supplied, also the cost of the handling, as against the high price of adulterated creosote oil as now used (which should be less), the reduction of the

pounds of oil from 20 to 12 or 16 would about equal this additional treatment in cost and would afford, I believe, a much better block. Especially would this be worth the while if it would solve the present difficulties and annoyances experienced from a bleeding pavement, a slippery surface and the evils connected with tracking into houses of the surplus tar on the surface.

H. C. INNES.
Consulting Pavement Engineer.
Cincinnati, O.

Concrete Pavement with Bituminous Wearing Surface.

Under the heading of Concrete Pavement with Bituminous Wearing Surface there appears in your magazine a letter calling attention to coated pavements laid at Ann Arbor during the last year or two.

I have personally experimented with coated pavements since the year 1906 of substantially the construction described in that letter. The great difficulty in constructing roadways with a coating of bitumen is the physical impossibility of making such coating unite with the comparatively smooth surface of the cement. After a great many attempts, but only partial success, it was found that the Portland cement had to be roughened or prepared by means of solvents so as to produce a surface receptive and retentive of the coating. Since then I have invented a great improvement on this construction by placing upon the concrete a bonding coat composed of neat Portland cement and a uniform sized stone, to which sometimes a small amount of sand can be added. This layer being firmly held to the foundation and in return firmly holding the bituminous cement which is subsequently poured into its pores, produces a surface particularly suitable for roadways of medium and light traffic. The weight and strain is taken up by the Portland cement and the mineral aggregate, while the resiliency is produced by the bituminous cement. For this reason the pavement is called Double Bond, or Bitucrete pavement.

While this pavement cannot be constructed at the cost mentioned in the letter you publish, its superiority and advantages more than over-balance the greater cost. A piece of the Bitucrete Double Bond pavement has just been laid at Morristown, N. J., where, during my presence, was hauled over the pavement a load of sixty-two tons in one single truck pulled by twenty-four horses, the pavement being then only about ten days old. It was not affected in the slightest degree nor was there a mark left after the load stood on the same spot for over half an hour.

The cut illustrates the laying of the pavement.

AUGUST E. SCHUTTE.
Boston, Mass.

LAYING BITUCRETE IN MORRISTOWN, N. J.

A Sanitary and Power Canal for Buffalo, N. Y.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The Chicago sanitary and ship canal has been cut through the divide between the watershed of the Great Lakes and that of the Mississippi Valley; it may well be called the greatest artificial waterway ever constructed; it is 32 miles long, 22 feet deep, and 160 feet wide, developing 40,000 horsepower, which is sold in Chicago at a reasonable price; it is in better condition hygienically than the ordinary river flowing through an inhabited country. It takes from Lake Michigan 10,000 cubic feet per second and 48 miles below there is no trace of Chicago sewage left.

At Buffalo sewage passes into Lake Erie and Niagara river, polluting the water supply of the city and of the whole Niagara frontier. Buffalo river and Smokes creek can be made to run backwards around the city, through Cheektowaga and on to Lake Ontario. There will be greater dilution than in Chicago and there is no reason why such

a canal should not be clear and odorless.

Where Buffalo river crosses the city line on the east, a private company, incorporated as the Erie & Ontario Sanitary Canal Company, proposes to excavate the canal deep enough and wide enough to stop the crest of the South Buffalo floods by carrying off the waters of Buffalo, Cayuga, Cazenovia and Smokes creeks, crossing under all the railroads that enter Buffalo from the east, and passing under the divide at Williamsville through a tunnel six miles long. After emerging from the tunnel beyond Williamsville, the open cutting will continue as far as the barge canal, where the sanitary canal will syphon under the barge canal, and where a lock will connect the two, so as to admit 2,000 ton barges through to Lake Erie. From the barge canal northerly, the sanitary canal will be built to Lake Ontario, but not navigable.

The flow of water backwards will protect drinking water from contamination and will provide drainage for all that great portion of Buffalo and West Seneca tributary to Buffalo river and Smokes creek, which includes such portions as now cannot be drained into any existing trunk sewer because of being too low to drain without pumping. The plan admits of great enlargement and all the Niagara frontier can be made to drain into this canal.

The government has already ordered Buffalo to abate the Albany street sewer outlet; The Tonawandas will be provided for by reversing the flow of Ellicott creek and running it into this canal.

222,000 cubic feet of water per second enter Niagara river, including the dirty water from Buffalo river and Smokes creek; the sanitary canal needs 6,000 cubic feet, or less than 3 per cent. In regard to lake levels, no such great amount of water need be taken as is taken from Lake Michigan for the Chicago drainage canal, and the 6,000 cubic feet per second will not be a menace to navigation or to the beauty of Niagara Falls.

There is a fall of 327 feet between Lakes Erie and Ontario, and this canal will be so located as to utilize 312 feet of the fall, and not waste any of the available power.

Modifications of present plans for preventing floods in South Buffalo and providing deep water for navigation in Buffalo river will be very slight, and no stoppage of those plans now under way will be necessary; this plan fits naturally into all other great plans for improvement projected by the City of Buffalo, by the state, and by the national government.

Many cities have been restrained from polluting streams, and Buffalo is as bad an offender as any; individuals and municipalities down the river are damaged, lives are endangered and fishing is destroyed.

For power purposes the 6,000 cubic feet of water will generate, under a 312 foot head, about 170,000 horsepower. The east end of Lake Erie and the Niagara river will be purified from sewage and storm waters, because all the small streams and the sewers of the Niagara frontier will be turned backwards away from the lake and river.

Although the canal will empty into Lake Ontario, the water will be purified before it reaches there; the scientific tests of the water of the Des Plaines river show that 48 miles from Lake Michigan there is no trace of Chicago sewage left.

Sanitary authorities now agree that self-purification of slow running streams, if not too heavily charged with organic pollution, is thoroughly effective by means of sedimentation, bacterial action, insolation, and other biochemic processes; and in this canal the process will be the more thorough because of greater dilution than in the Chicago drainage canal.

The accompanying drawing shows the general location of the canal and the drainage and sewerage lines which it will intercept and turn from Lake Erie and the Niagara river.

Under the Canadian-American waterways treaty of May, 1910, an International Joint Commission has been formed to hear cases involving further withdrawal of water from Lake Erie or the Niagara river above the falls. This commission is now fully organized and the petition of the company for the award of the necessary water from the lake will soon be heard. J. W. H.

"THE NATURAL SOLUTION"

MUNICIPAL MATTERS IN COURT

Higher Courts.—Michigan Decisions on Bitulithic.

Decisions of the Higher Courts of Interest to Municipalities.

Advance Payment on Construction Contract Does Not Release Surety on Bond.—Where a contract to construct a sewer for a city, stipulating that each month the city's engineer should make an approximate estimate of the value of the work done, and that thereon payments should be made, provided that the engineer should be the referee to decide on the amount of work to be paid for under the contract, and that his estimates and decisions should be final and conclusive, his making in good faith too large an estimate for a certain month, in consequence of which the payment for that month was too large, but for which deductions were made in subsequent months, was binding on all parties, so that the payment thereon could not be considered an advance, with the effect of releasing the surety on the contractor's bond.—Town of Wakefield v. American Surety Co. (Mass.), 95 N. E. 350.

Idem.—The surety on a municipal contractor's bond securing payment of material men is not discharged from liability to them by premature payment to the contractor, after the material claims accrued.—Empire State Surety Co. v. City of Des Moines et al. (Ia.), 131 N. W. 870.

Attempt to Evade Constitutional Debt Limit Invalidated Laporte's Purchase of Water Works.—A city owning a water works plant, but at the time without a supply of water suitable for domestic use, and being unable because of the constitutional limitation on its indebtedness to build an extension to secure an adequate supply, passed an ordinance by which it granted to a water supply company organized for the purpose the right to lay pipes through the streets and public grounds to its reservoirs, and to build a pumping station on its water works site, and contracted to buy from the company for a term of years a stated number of gallons of water per month delivered in its reservoir, and also to purchase $30,000 worth of the company's stock. The company agreed to procure an adequate supply of pure water from a designated source outside of the city, purchase right of way, and construct works and pipe lines to bring the same to the city. After the passage of the ordinance suit was brought by taxpayers against the city, its officers and the water supply company to restrain the carrying out of the contract or the issuance of bonds by either party, but a preliminary injunction having been denied, the city issued and sold bonds for $30,000 and paid it for stock of the company, with which, together with the proceeds of bonds issued by the company, secured by mortgage on its property, the extension was made. The city then purchased for $10,000 the remaining stock of the company from the contractors to whom it had been issued, and who were also the incorporators of the company, and the city operated the entire plant. By final decree in the taxpayers' suit subsequently entered it was adjudged that the ordinance and contract of the city were ultra vires and void, as having been made pursuant to a fraudulent scheme devised by the city officers and contractors to evade the constitutional limitation upon the indebtedness of the city, and entirely by the city and from the proceeds of the bonds issued by the company, and the city was enjoined from making any further payments under the ordinance or upon the bonds of the water supply company. Held that, under the rule of lis pendens, such adjudication was binding on the mortgagees of the company, and was conclusive against their right to recover from the city on the bonds or to foreclose on the pumping works or pipes of the company which were located on city property or in its streets, and which constituted permanent improvements thereon made without right, but that the same adjudication determined that the city never acquired any right or title to the property of the company outside of its limits, legal or equitable, which was therefore subject to the mortgage.—City of Laporte, Ind., v. Northern Trust Co. et al., 187 Fed. 20.

Street Sewage from Water Appliances and Laundry is a Nuisance.—The maintenance of a private sewer from plaintiff's hotel to a public street, discharging into the street sewage from all the water appliances and laundry of the hotel, constituted a nuisance per se which was subject to abatement without without ordinance or adjudication either by the city authorities or by private individuals. Sullivan Realty and Improvement Co. v. Crockett et al, 138 S. W. 924.

Waterworks Must Meet Specifications.—An ordinance embracing an agreement between

the city and a water company provided for a certain test of the waterworks, and that if such test should be demanded by the city council, and it should be found that it could not be satisfactorily made owing to a deficiency in the water system, then the city should be free from obligation to pay hydrant rental from 10 days after date of such trial to such time as the test could be sufficiently made. *Held*, that, from 10 days after subjecting the system to such a test showing a deficiency therein, to meet the calls of the test, the city would be freed from the obligation of paying hydrant rental, and for the water company to recover such rental, it devolves upon it to show that the water system complied with the test; that being a condition precedent to recovery. Antigo Water Co. v. City of Antigo (Wis.), 128 N. W. 888.

City Not Liable for Water Supply.—Where a municipality maintains a public water system, it is acting as a governmental agency, and is therefore not liable for negligence in maintaining the water supply. Oakes Mfg. Co. v. City of New York (N. Y.), 125 N. Y. 1030.

What Determines the Lay Out of a Street.—The city of Boston took part of lands for a short parkway, to be controlled by the park commissioners, and made a settlement with the owner, by which the city agreed to construct a roadway and walk, to which he should have perpetual access, and to assume any assessment for betterments for the construction of the park on the land not taken. Subsequently the city street commissioners laid out a street several miles long, which, where the owner's land lay, was superimposed on the parkway, and no physical change was made therein. *Held*, not to preclude assessment for betterments on the owner's lands for the new street, which was a wholly new layout by the commissioners; to "lay out" meaning in this connection, to fix the termini and prescribe the boundaries of a highway, and establish it as a public easement of travel, by official act of the proper authorities. Leahy v. Charles et al Street Com'rs (Mass.), 95 N. E. 834.

Factors Which Determine the Right to Unmetered Water.—Water used in operating a cafe, billiard room, bar, barber shop, and garage in connection with apartment houses, is used for "business consumption," within New York City waterworks regulations, permitting a commissioner to require installation of meters. An owner of an apartment house, operating a cafe, etc., for the use of his tenants, in which meters are ordered by the water commissioner, cannot claim the right to frontage water rates as to consumption outside the cafe, etc., where the plant is not arranged for the separate service. The New York City ordinance fixing frontage water rates being limited to buildings at least five stories high, an owner of an apartment building exceeding that height is not entitled to such rate. Johnson-Kahn Co. v. Thompson et al (N. Y.), 130 N. Y. S. 216.

Two Michigan Decisions on Bitulithic Patents.

The validity of the Warren patents, covering the admixture of different sizes of stone with bitumen in the wearing surface of a street pavement, has again been before the courts in two recent cases in Michigan.

The questions raised in these latter cases seem to have turned upon the sizes, quantities and proportions of stone required to be used under the specifications. In the case against the city of Holland, Mich., after the issues were made up, counsel for defendants withdrew their appearance in the case and permitted a judgment *pro confesso* to be taken, upon which a perpetual injunction has been issued, enjoining the defendants from "directly or indirectly making, using, vending or selling to others to be used, said improvements and inventions as described and claimed in the fifth, sixth, ninth and eleventh claims of said Letters Patent, No. 727,505, or any material or substantial part thereof;" and expressly holding that "a pavement constructed under the specifications adopted by said city of Holland for the improvement of Central avenue, as set forth in the bill of complaint, would necessarily constitute an infringement of one or more of the claims of said patent."

In the case against the city of Grand Rapids, where the New York convention specifications were modified by reducing the specified maximum size and proportions of the mineral aggregate (the specifications requiring the use of no stone coarser than one-half inch), after hearing the case argued on the affidavits filed by both sides, the court entered an order in the case, in which it was provided that, if within ten days thereafter the defendants would give bond in a sum sufficient to cover the damages to be sustained by complainant in a given amount fixed by the court as liquidated damages, in the event it should finally be determined that the patent had in fact been infringed upon by the construction of the pavement as actually laid, the application for the injunction would be denied.

This order of the court further provided that, if the defendants failed to give the bond specified, the complainant, upon giving bond in an amount fixed by the court to cover the damages sustained by the defendant, in the event it should be finally determined that no infringement had in fact been made, a preliminary injunction should issue, as prayed for. The order also provided that the work, if done, should be completed in strict compliance with the specifications.

The defendants failed and refused to give the bond to prevent the issuance of an injunction. The complainant immediately filed the bond as prescribed by the court, and the preliminary injunction was issued as prayed for in the bill.

The Holland case is thus finally disposed of, while the execution of the work under the Grand Rapids specifications is enjoined.

FIRE AND WATER

Monrovia Municipal Water Plant—Wheeling Municipal Plants—Columbus Water Works Pawn Shop—New London Water Works.

Monrovia, Wis., Municipal Water Plant.

The annual report of M. T. Gettings, superintendent of the Monroe, Wis., municipal water works plant, indcates a net revenue of $1,428 for the year. A total of 86,000,000 gallons of water was pumped and 800 tons of coal were burned. The total revenue of the plant was $17,260.

Municipal Ownership in Wheeling, W. Va.

In Wheeling, W. Va., the city water system is owned by the city, and the same is true of the electric street lighting plant and artificial gas plant.

The water supply of Wheeling comes from the Ohio river, from which it is pumped to a large reservoir on the top of Wheeling Hill, and is distributed from that point over the city to a portion of the suburbs. A new pump is being installed at the pumping station having a capacity of twenty million gallons a day.

The flaw in the water supply of the city is the condition of the river, which, at some seasons of the year, is such as to affect the purity of the water.

A movement is now on foot to install a filtration plant in the river at a point just above the water works. It is probable that the question of a bond issue for this purpose will be submitted to the people in the near future.

Wheeling is plentifully supplied with natural gas by private corporations and with artificial gas by the municipality. The artificial system has been the cause of much controversy during the past few years, but a solution is now in sight. A plant for the manufacture of water gas is now in course of construction and will supply it at a very moderate cost. The fight for the retension of this property was long and bitter but successful.

The city manufactures power for its street lights in a well equipped electric plant. A proposition to furnish lights has been made by a private corporation, but refused.

In 1908, a bond issue was passed to provide for certain improvements advocated by the city government. A number of these have been completed and the others are now nearing completion. Among the more notable are the water works improvements, costing $350,000; the new gas works, costing $110,000; street improvements to the value of $150,000; the new Market street bridge, erected at the cost of $55,000; the new incinerator, at a cost of $35,000, and the Caldwell's run improvements at a cost of $25,000.

A Municipal Pawn Shop Proposed to Loan Columbus, O., Water Works Deposits.

If the plan of the city officials develops Columbus, Ohio, will soon have a municipal pawn shop. It is planned to operate the pawn shop in connection with the waterworks department, which is also owned by the city, and the deposit funds of the water works department, which are required of customers, will provide the capital to be loaned out. Opposition to the ordinance which was adopted by council recently came from the fact that no money was in the city treasury or would accrue there under the Smith one per cent. tax law, which could be used for loaning purposes. Councilmen declare they have reached a solution of the problem by combining it with the waterworks office, and another ordinance with these provisions will be introduced in council. The clerks of the waterworks department will also look after the pawn shop, thus doing away with the necessity for additional clerks.

The Water Works System of New London, O.

The question of installing a water works system in New London, O., was agitated in 1904. The council reported in favor of the Bonney Creek impounding reservoir as a source of water supply, and submitted plans, specifications and estimates which involved the expenditure of $60,000.

About two years ago the subject was

again brought to the attention of the council and J. F. Cole of South Bend, Ind., submitted plans providing for a water supply from wells using a compression storage tank system, involving an expenditure of between $30,000 and $35,000. According to the village tax duplicate at the time this would be too large a bond issue to be secured by a vote of the people.

A supply of water was developed by drilling two wells about 100 feet apart which are said to furnish approximately one hundred and seventy gallons per minute. The water has been pronounced entirely satisfactory by the State Board of Health.

In the meantime the Ohio Legislature passed the Crosser I. & R. act, providing for the submission of ordinances of the kind necessary to adopt the "franchise and lease plan" to be submitted to a vote of the people at the regular election, if ordered by petition of the electors.

The New London Water Company having been duly organized, the council met on September 30th and passed Ordinances Nos. 427 and 428 by the unanimous affirmative vote of the six members thereof. The referendum election was then ordered by petition of the electors and notice of such election has been given to take place at the regular November election. Both ordinances must be approved to insure the installing of the plant.

Ordinance No. 427 grants a franchise to the New London Water Company in language which is similar to all such franchises granted to private water companies in this state, and will be approved by the Public Utilities Commission. Section 8 fixes a price of $45 per year as rental for each fire hydrant, which is somewhat lower than the price paid by towns taking water for fires and flushing purposes from private companies. The plant is to be leased by the village and this hydrant rental, which is enough to pay 4½ per cent. interest on $33,000 and to set aside over 1 per cent. of that amount as a sinking fund, is intended to be paid by the council into a fund to be applied on the rental of the plant, and as provided in Section 15, on the purchase price of the plant; and the final purchase may be consummated at any time during the life of the franchise. by issuing the 4½ per cent long time bonds of the village for the unpaid amount.

Ordinance No. 428 authorizes and directs the mayor and clerk to enter into a ten years' contract of lease for the water works system, and stipulates the amount of rental to be paid. The village is to pay $2,000 when the water works system is completed and accepted, and $3,100 annually thereafter for ten years. All over 6 per cent. interest so paid applies on the purchase price as provided in ordinance No. 427.

A bill recently passed by the Ohio Assembly provides that bonds may now be issued by villages for the purchase of self-supporting water works, which need not be considered when figuring the bond limit.

Taking into consideration the fire hydrant rental, the plant is expected to be self-supporting within twenty months after commencing operations. The cost of operation will be low, and experience shows that water takers usually number as many as electric light users in towns the size of New London. There are over three hundred and fifty consumers of electric light and power current here.

If these ordinances are approved by the people, The National Company, which is promoting the plan, expects to begin work in November so that the business portion of the village may be assured of adequate fire protection soon after Jan. 1, 1911.

The plans as finally approved and adopted provide for the laying of 2950 feet of 8-inch pipe, 4800 feet of 6-inch pipe, and 12,480 feet of 4-inch pipe, and the setting of 40 hydrants and 18 valves. Along paved streets the fire line will be laid between curb and sidewalks on one side of such streets, and two-inch service pipes will be lriven under the street every few hundred feet to furnish water to patrons on the opposite side. Faved streets, therefore, will not be torn up longitudinally, but only in crossing them at several places on one side of street intersections.

A special electric power line will be run from the present municipal electric light and power plant to the land where the wells are located. Isolated pump houses of brick will be located at each well, each furnished with one upright deep well pump, with 10 h. p. 110 v., d. c. motor with pressure type auto starter and the necessary pipes and discharge fittings.

The central station building will be of brick, 24x60x11 feet, and will be furnished with two 9x38 feet compression storage tanks, built of specially rolled steel of 60,000 lbs. tensile strength tested under air pressure of 100 lbs. to the square inch and made perfectly tight—guaranteed to stand a working pressure of 65 lbs. to the square inch, which is equivalent to a head of 150 ft., together with the necessary pressure and water gauges and special fittings and connections. Another set of tanks may be easily added when deemed advisable. In the open part of the central station will be located one 8x8 double acting air compressor with a 10 h. p. motor and necessary pipe fittings, connected with the tanks to boost the air pressure. Here also will be set in place two 8x10 triplex pumps, each with a 20 h. p. motor for use in case of emergency or fire, connected with a 35,000 gallon capacity re-inforced concrete reservoir or cistern, size 20x15 feet, with walls 10 feet below the surface, this cistern to be roofed.

National Road Improvements—Injury to Streets—Progress in Good Roads.

National Road Improvements in Eastern Pennsylvania.

A movement has been instituted by the West Alexander (Pa.) Board of Trade to secure the improvement of the National road through West Alexander. State Highway Commissioner E. M. Bigelow, of Pittsburg, and other prominent officials looked over the situation that plans might later be made for the paving. Recently the state of Pennsylvania appropriated $350,000 for the improvement of the National pike, through the counties of Washington, Fayette and Sommerset, and it was the original intention of the commissioners of Washington county to start at the state line and macadamize the thoroughfare to a point beyond the limits of West Alexander. It was planned to make this stretch of road equal to the Flynn road.

The Board of Trade has taken up the matter of paving, instead of macadamizing the road, with the officials in charge and it is likely the concession will be granted.

Movement to Prevent Injury to Streets.

As a result of the tearing up of Scotland road by the Public Service Electric Company soon after it had been resurfaced and a request from the New York and New Jersey Telephone Company to tear up Charleton avenue, which also has been resurfaced, Chairman Frederick J. Lovatt, of the South Orange, N. J., street committee, secured the adoption of a resolution by the South Orange Village Board of Trustees that in the future any company which desires to tear up any road in the village must give six months' notice.

Recent Progress in the Good Roads Cause.

The holding of the convention of the American Association for Highway Improvement suggests a summary of recent progress in the field it covers, and MUNICIPAL ENGINEERING has expended considerable time, energy and money in making a collection of information sufficient to show how remarkable recent progress has been and how it has opened the way for still more rapid progress in the immediate future.

The brief state histories, which follow, give no idea of the time and effort necessary to secure the passage of the first road laws, but they show clearly the rapid increase in the interest in good roads, the progressive increase in appropriations, the improvements in methods and results which follow as soon as the law has had an opportunity to demonstrate its value. State aid has fully demonstrated its value in every state in which it has been tried; and the success in the states first adopting it, such as New Jersey, Connecticut, Massachusetts, New York, Maine, etc., has resulted in a large number of adoptions of the plan within the last two or three years. These are already demonstrating in their turn the value of the state aid plan; and as soon as they in their turn get their organizations in good running order there will be another rapid advance in the mileage of good roads put under construction. It is not necessary to point out these states. The following abstracts of the data gathered will show which they are, and make it possible to compare the general methods and results in all the states.

Acknowledgments are due to the U. S. Office of Public Roads, the American Association for Highway Improvement, the state road officials and many county road officials for information furnished. No such collection and comparison has yet been made as is here presented; and the only regret is that the data are so full that they must be made into a continued story. As much as possible is crowded into this number; and the data from the states farther down the alphabetical list will appear in subsequent numbers of MUNICIPAL ENGINEERING.

Attention is called to the valuable articles on roads and pavements in this number. It is a special number prepared for the Richmond convention; but the good roads movement is now so widespread and is advancing so rapidly that information about it will be given as fully as possible in each monthly number of this magazine. Several excellent articles on road materials and methods of construction have been crowded over into next month, and others are definitely promised for early publication. As usual, MUNICI-

PAL ENGEERING will do its utmost to keep in the front of the procession.

The following concerning the road work in the states, which are treated in alphabetical order, will be found of great interest, and presents much that has never been presented in as definitely comparable form in print.

ALABAMA.

The first state highway laws in Alabama went into effect April 5, 1911, so that they are not yet in full operation. The state highway commission consists of Robert E. Spragins, Huntsville, chairman; John Craft, Mobile; V. B. Atkins, Selma; Dr. E. A. Smith, University, and Prof. G. N. Mitcham, Auburn. W. S. Keller, Montgomery, is the State Highway Engineer. The first detail of the duties of the state highway engineer is the preparation of a map of the roads of the state and the designation of those which should belong to a system of trunk line or state roads, to be submitted to the legislature. He is instructed to establish standards of construction and maintenance, to advise local road officials, and have supervision of roads constructed under the act.

The first appropriation is of $154,000 a year from the convict fund, and limits the commission's expenses to $10,000 a year with authority to the governor to increase to $20,000. The remainder is apportioned equally among the counties and the governor may increase the apportionment to $4,000 a year per county if the funds permit for each county that appropriates a like amount for use on its roads. The regulation of the expenditure is in the hands of the highway commission and on roads costing more than $3,000 is in direct charge of the state highway engineer. Money not used within two years reverts to the state treasury. Repair of state roads is prescribed.

The department has issued bulletin No. 1 containing the law and is now issuing No. 2 containing articles on construction and maintenance of highways.

Of the 67 counties of the state 37 have applied for state aid and some construction is already under way.

The local roads are in charge of the court of county commissioners which includes the judge of the probate court and four commissioners, who appoint a supervisor of public roads. Counties are divided into precincts, with an apportioner and an overseer for each precinct. Convicts are employed in work on roads.

As an example of the awakening activity in the state Calhoun county may be cited, as setting an election in November on the issue of $350,000 bonds for construction of several trunk lines across the county. A half-mile of macadam road was built under the direction of the U. S. Office of Public Roads in Calhoun county which cost about $5,700 a mile, so that the county has a short example of what it is proposing to vote upon.

Improvements have been made on 6.59 per cent. of the toal mileage of roads. Alabama has a population of 2,138,093, is increasing at a rate over 15 per cent. per decade and its 67 counties range in population from 13,000 to 226,000.

ALASKA.

Alaska has a board of road commissioners which expended $260,000 in 1910 on 1843 miles of roads, winter and summer trails.

Up to June 20, 1909, there had been constructed or improved in all, 165 miles of wagon roads, 383 miles of sled roads and 241 miles of trail at a cost of about $690,000 obtained in part from U. S. appropriations and in part from "the Alaska fund."

Alaska has a population of 64,356 and its four districts range in population from 12,000 to 20,000.

ARIZONA.

The territorial engineer of Arizona, J. E. Girand, Phoenix, expended $200,000 in 1910 in constructing bridges, locating and grading roads. The original law regarding state roads was passed in 1909.

The tax levy for 1911 is 25 cents per $100 valuation in counties covered by the proposed system of highways and 5 cents in others.

Local roads are in charge of county boards of supervisors of three members each, who appoint a county superintendent of roads, and of trustees, three elected in each district in the ecounty.

Arizona has a population of 204,354 and is increasing over 65 per cent. per decade. Its 13 counties range in population from 4,000 to 35,000.

ARKANSAS.

Arkansas has no state road organization. Local work is in charge of the county court, county judge and at least two justices of the peace for each township, who appoint a county road commissioner. A road overseer is elected in each township. Convict labor is employed on the roads. Improvements have been made on 2.97 per cent. of the roads of the state.

Arkansas has a population of 1,574,449 and is increasing 20 per cent. per decade. Its 75 counties range in population from 9,000 to 87,000.

CALIFORNIA.

The new California highway commission was organized very recently and consists of Burton A. Towne, chairman; Charles D. Blaney and N. D. Darlington. Austin B. Fletcher, Sacramento, is the highway engineer and Wilson R. Ellis is the secretary. The law authorizes the issue of $18,000,000 bonds of which the first installment of $400,000 is now on the market. This sum

is to be expended in constructing and maintaining a system of state highways. For the years 1911-12 and 1912-13 the appropriations are $133,000 each. The counties are required to pay interest at 4 per cent upon all money spent in the county until the bonds are retired as provided.

From 1907 to 1911 the state roads were in charge of the state engineer and recent appropriations have been about $150,000 a year for construction, repair and maintenance of roads in mountainous districts, mainly, the total being $403,300. The last report of the state engineer on roads describes eight of these roads with a total length of about 300 miles, some of which are not yet finished. The same report shows that the taxes levied for road purposes in the various counties to be spent in 1910 amounted to $3,340,333.66. Prior to 1907 the state roads were under a state department of highways with a state commissioner in charge.

Under the laws for county and district construction of roads the local roads are in control of a board of five supervisors and a county surveyor. There is also a county board of forestry of five members. Each township or district has also a road commissioner.

Some counties have bonded themselves heavily for local construction of roads, notably San Diego, $1,250,000; Los Angeles, $3,500,000; San Joaquin, $1,890,000; Sacramento, $660,000.

Los Angeles county's plan includes 307 miles of road, of which there had been opened at the end of 1910 76.33 miles of oiled macadam and 14.25 of finished grading, bridges and tunnel, with 170.32 miles under contract or advertised for the letting of contracts. The liberal policy of the state and the opportunity for the application of equally liberal policies in the counties of the state are beginning to show their results; and California bids fair to be one of the most active states in road building, both state and local, for a number of years.

The use of oil upon highways has been developed to a large extent in California, and at least one-tenth of the 50,000 mileage of roads in the state is now oiled, or more thoroughly treated with oil during construction. The average cost of oiling is about 3½ cents a square yard, though some roads have cost double that amount.

Convict labor is employed in preparing road materials and in road building.

There are 48,069 miles of road in the state of which 8,588 have been improved.

California has a population of 2,377,549, is increasing in population about 60 per cent. per decade, and its 58 counties vary in population from 300 to 504,000.

COLORADO.

The highway work of Colorado has been in the hands of the state engineer since 1907, and some $125,000 for road construction and $50,000 for bridge construction were appropriated by the legislature for special roads and bridges and expended under his supervision. The legislature established a highway commission in 1910, of which W. N. Wiley, Denver, is state highway engineer, and J. E. Maloney, Denver, is secretary. The governor seems to have vetoed all appropriations made for the construction of roads and bridges, but $25,000 for the commission was approved. The attorney-general of the state has recently decided that the internal improvement and internal improvement income funds, amounting at the time of the decision to $233,678.83, are available for use and distribution to counties for road work. The commission, if it so desires, can distribute 90 per cent. of the funds to the counties and reserve 10 per cent. for equipment, repair and maintenance of roads under its own direction. None of this fund is as yet available. The state pays one-third the cost of state aid roads, the county two-thirds.

Local roads are in the hands of the board of county commissioners, 3 members each, who appoint a county superintendent of roads and divide the county into suitable township or road districts and appoint an overseer for each.

Some convicts are employed in crushing rock and they have been employed in constructing a few state roads. Colorado has a population of 799,024, which is increasing at almost 50 per cent. per decade, and its 60 counties range in population from 1,000 to 213,000

There are 29,693 miles of road in the state, of which 320 have been improved.

CONNECTICUT

The roads of Connecticut are supervised by the state highway commissioner, James H. MacDonald, Hartford. In case the board of selectmen of any town petition him successfully for the construction of a road he makes plans and receives bids and he and the selectmen all sign the contract. The selectmen may bid for the work on behalf of the town. If the property valuation in the town is more than $1,250,000, the state pays three-fourths the cost of construction, if less, the state pays seven-eighths, with a limit of $500,000 expenditure per year by the state on this account. The highway commissioner may build state roads as he may desire to the extent of $1,500,000 between 1907 and 1913. He keeps in repair all roads constructed under the law, not exceeding $50,000 from state funds. The limit of the fund for maintaining the highway commissioner's department is $65,000. The law applies only to main highways leading from one town to another.

The total expenditures on state aid and trunk line roads were $4,700,572, from 1895 to 1910, inclusive.

In 1907 a bond issue of $4,500,000 was authorized, to furnish funds for six years work under the new law of that year.

The appropriations made for 1907-8 were $999,868 by the state and $224,932 by the towns for general roads and $227,806 by the state and $55,805 by the towns for the trunk line roads.

For the years 1912 and 1913 the legislature has appropriated $2,000,000 for trunk line roads, $1,000,000 for other main roads, $200,000 for repairs, all of which are made by the state, and $220,000 for expenses of administration, making a total for the two years of $3,420,000

In 1907-8 92.75 miles of road were com- 146.59 miles under contract and not completed at the close of 1910. There are 12,583 miles of roads in the state, of which 3,031 have been improved, 801 of them in whole or in part by the state.

The change in methods of handling financial matters is shown by the change in the proportion paid by the state, from 1/3 to ¾ or ⅞; by the increase in allowable expenditure by towns from $3,000 a year in 1895 to $10,000 at present; by change from three commissioners in 1895 to one since 1897; by change from requiring towns to pay engineers' fees, advertisements and inspection by transferring these expenses to the state, inspection in 1899, and the others in 1903; by changing authority for receipt of bids and awarding of contracts from towns without restriction in 1895, to approval by the state commissioner in 1899, and to entire control by the state commissioner in 1907; by insertion in 1897 of provisions by which the state commissioner could let contracts amounting to less than $1,000 to the town itself without competition and by which the town could compete with other bidders on larger contracts; by change of the provision of 1895 whereby the selectmen chose the roads to be improved to that of 1901 giving the state commissioner a veto power, with the further provision of 1905 that the state commissioner could construct trunk lines without consulting town authorities, and finally to that of 1907 placing the full choice of roads to be improved with the state commissioner; by changing the obligation of 1895 of the towns to repair roads at their own expense, with the provision of 1901, without penalty, that the state commissioner could order repairs made by the towns, to that of 1905 appropriating $10,000 a year to loan money to towns to make repairs, and later to that of 1907 appropriating $25,000 a year and the proceeds of automobile licenses to pay three-fourths of the expense of repairs, and still later that of 1911 appropriating $200,000 a year and assuming for the state the whole burden of making repairs on state aid roads; the classifications of towns in 1899 so that towns of less than $1,000,000 (later $1,250,000) assessed valuation should receive greater proportion of state aid than those of higher value; the insertion in 1903 of the obligation to plant trees along all state road work as a part of the improvement; by the purchase of portable stone crushers under the law of 1903 for use of towns; the removal in 1907 of the time limit on appropriations so that one made to a town would remain in force until expended; the authorization of the $4,500,000 bond issue to cover six years' work; the increase of annual state appropriations from $75,000 in 1895 to $100,000 in 1897, $175,000 in 1899, $225,000 in 1901, $229,500 in 1905, $750,000 in 1907, $1,000,000 in 1909, and $1,710,000 in 1911.

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The population of Connecticut is 1,114,756, which is increasing over 20 per cent. per decade, and its 8 counties range in population from 26,000 to 337,000.

DELAWARE.

The roads of Delaware are under two state highway commissioners, one each for New Castle and Kent counties; viz., Francis A. Price, Wilmington and C. B. Hope, Dover, and one county engineer, Mr. Mustard of Georgetown, Sussex County. New Castle County is the only one showing activity in road construction, having built over 50 miles in 1909 and 1910, largely macadam, less than a half mile being bituminous macadam.

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There are 3,000 miles of road in the state, of which 187 have been improved.

There are only two road supervisors for each district in Sussex Co., and one for each "hundred" in Kent Co.

Delaware has a population of 202,322, which is increasing less than 10 per cent. per decade, and its 3 counties range in population from 33,000 to 123,000.

DISTRICT OF COLUMBIA.

The roads of the District of Columbia are under C. B. Hunt, the engineer of highways of the city of Washington and may be considered largely as suburban streets.

The population of the District, mainly within the city of Washington, is 331,069 and it is increasing nearly 20 per cent. per decade.

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FLORIDA.

There is no state supervision of roads in Florida. The roads are in charge of boards of county commissioners of five members, who appoint the county superintendent of

roads. Each county commissioner's district is a road district and there are three road commissioners for each district. An overseer is appointed for each sub-district. There is little activity in road construction except in the vicinity of Jacksonville and St. Augustine, where some paving is done, and along the selected lines of proposed national highways, where some sand-clay roads are being built. The macadam roads near Jacksonville have cost about $1 per lineal foot. The sand-clay roads cost from 10 to 50 cents per linear foot, 14 to 16 feet wide and 7½ to 9 inches thick. Pine-straw, so-called, is a surfacing used in some counties at a cost of $50 a year, renewals being made once a year or oftener as the slight traffic requires. Good roads meetings are being held to develop interest in permanent improvements. It is reported that 10 per cent. of the road mileage in the state has received some sort of improvement.

The law gives authority for working part of the state's convicts on the roads but this has not yet been done.

Florida has a population of 752,619, which is increasing over 40 per cent. per decade, and its 47 counties range in population from 4,000 to 78,000.

GEORGIA.

The State Geologist is the state official having road matters in charge. Construction is in the hands of the "ordinary" and the commissioners of roads and revenues, and a county engineer. An overseer is appointed for each road district into which a county is divided. Most of the work on roads is done by the county's convicts. Many miles of sand-clay roads have been built and many miles of roads are graded and drained where even the sand or clay for such roads is lacking Thus one county (Irwin) reports 30 miles of roads graded and drained in 1911 at a cost of $9,000, or $300 a mile. Assessments of $39,000 have been made on property benefited by such construction on the 100 miles of opened road in the same county. The average cost of building roads in the state is reported as $1,639 per mile for macadam, $1,200 for gravel, and $426 for sand-clay roads. Both state and county convicts are used in road construction under the law of 1908.

There are 82,232 miles of road in the state, of which 5,978 have been improved.

Georgia has a population of 2,609,121, which is increasing nearly 20 per cent. per decade, and its 146 counties range in population from 3,000 to 178,000.

HAWAII.

The belt road commission has a plan for a road around the island of Oahu for which the legislature has appropriated $200,000 of the $250,000 required for its completion.

The territory of Hawaii has a population of 191,909, which is increasing nearly 25 per cent. per decade. The population of the island counties varies from 800 to 82,000.

IDAHO.

A. E. Robinson, Boise, state engineer of Idaho, reports but one state road, which was built in 1911, is of macadam, somewhat over 3 miles long, and has cost the state $20,000. The appropriation for 1911 was $53,000. The original road law was passed in 1905, and a more complete law, passed in 1909, was declared unconstitutional. The state pays the full cost of state roads. Local roads are in charge of boards of county commissioners of three members each. They divide the counties into road districts in each of which a road overseer is elected annually by the people.

There are 18,403 miles of road in the state, of which 510 have been improved.

Idaho has a population of 325,594, which is increasing over 100 per cent. per decade, and its 23 counties range in population from 3,000 to 29,000.

ILLINOIS.

Illinois since the law of 1903, has had a state highway commission, now composed of Pres. Edmund J. James, chairman, Urbana; Joseph R. Fulkerson, Jerseyville; and LaFayette Funk, Shirley, with A. N. Johnson, Springfield, as state highway engineer. The commission has advisory powers only and has been doing some experimental work.

Under one act of the legislature the state penitentiaries have furnished since 1906 some 376,688 cubic yards of broken stone, which has surfaced some 380 miles of road. This is distributed approximately 25 miles in 1906, 45 miles in 1907, 75 miles in 1908, 80 miles in 1909, and 155 miles in 1910 and 1911. The department supplied in 1911 plans, advice and inspection for 20 steel bridges and 200 reinforced concrete bridges, as well as for the road construction. The department has also supervised during the year the construction of 20 miles of bituminous macadam, using different materials on each mile and 10 miles of ordinary macadam, using both the stone from the convict labor and stone furnished by local authorities.

The state has 94,141 miles of roads in use, of which 8,914 miles have been graveled or macadamized, including a few miles of bituminous macadam and brick roads and the 20 miles of bituminous macadam cited above.

The annual road and bridge taxes in the counties of the state increased from 4,000,000 in 1905 to $5,250,000 in 1909, to which should be added estimated amounts of $250,000 for county aid, $300,000 for hard road taxes and the estimated value of the labor tax, over $400,000, making the total annual local expenditures for constructing and maintaining roads some $6,200,000 in 1909, with a tendency to increase about $500,000 a year. In the 5 years, 1905 to 1909, the hard road taxes amounted to $1,533,582, averaging the $300,000 per year given above. The total expenditures on state aid roads prior to 1911 were $280,000, and the appropriation for 1911 was $65,000.

The department made a careful study of the traffic on country roads in 1906-7, on which a full report has been published.

The state has a road drag law whereby contracts may be made, preferably with adjoining landowners, to use the road drag at rates not exceeding $1 a mile each dragging in 4 winter months and 75 cents in the other 8 months, April to November inclusive. But little has been done by commissioners under this law. Illinois is laboring under the difficulties of little material for making good roads, an unfortunate advocacy by some prominent engineers of dirt roads and a neglect by the local commissioners of even the means recommended for making dirt roads better.

In counties not under township organization the local roads are in the hands of boards of three commissioners of highways and a district clerk as treasurer. The county is divided into these districts by the board of county commissioners. The boards of highway commissioners and overseers are appointed for each road district. Counties under the township organization have a county board of supervisors composed of the township supervisors. Each township has 3 township commissioners of highways who appoint an overseer for each district in the township.

Ordinary macadam roads are expensive in this state, say $7,100 a mile.

INDIANA.

The roads in Indiana are in charge of boards of county commissioners of 3 members each and of the township trustees, one in each township. Each township is divided into road districts with a road supervisor for each district having particularly in charge the working out of labor taxes on the roads. All of these officers are elected by the people and, notwithstanding the mixture of independence and supervision, some good results are obtained and many miles of improved roads are built each year. The county surveyor usually has charge of the engineering of the roads.

Of the total mileage of roads in the state 19,951 miles had been improved with gravel in 1904 at an average cost of $1,472 a mile, and 5,172 miles of broken stone roads at an average cost of $2,210 a mile At the same time the average cost per year for repairs was stated to be $88 for gravel roads and $48 for macadam roads.

No such complete statistics have been collected since that date, but the following comparison of certain counties for which data for 1904 and 1911 are at hand will give an idea of the extension of improvements during the 7 years:

COUNTY	Roads Built Prior to 1904.		Roads Built Prior to 1911.		Roads Built in 1911.		Cost of Roads Per Mile in 1904.		Cost of Roads Per Mile in 1911.		Miles of Road in County
	Maca.	Grav.	Maca.	Grav.	Maca.	Grav.	Maca.	Gravel.	Maca.	Gravel.	
Adams	115	102	...	...	25.	...	$3,200	$2,000	$3,000	$	525
Clay*	32	186	5	306	0.5	14	2,500	2,000	5,000	3,590	...
Grant*	...	460	...	600	15.5	6	....	2,000	3,616	2,333	....
Hancock*	...	402	40	635	...	2	....	900	....	2,000	980
Knox	64	200	105	320	5.	10	2,000	1,800	2,600	3,500	....
LaGrange	...	275	...	150	...	10	....	750	....	....	....
Madison*	...	325	15	740	5.	60	....	3,500	....	....	810
Orange	128	40	230	20	15.		1,800	1,250	2,000	....	450
Posey	65	31	78	111	10.		3,785	2,456	3,000	....	1,000
Pulaski*	13	67	23	171	.0	18	2,600	1,383	....	1,667	....
Spencer	29	...	29	...	3.	...	2,000	....	3,000	....	1,500
Sullivan	60	272	...	...	21.	11	3,200	2,600	3,300	4,330	400
Union	...	251	5	200	5.	...	....	600	4,952	....	240
Vigo*	...	220	22	309	7.7	17	....	1,414	2,520	3,476	739

*Clay county built 2 miles of road treated with Tarvia X in 1911, at a cost of $9,110 a mile.

Grant county's macadam roads are included in the gravel roads.

Hancock county has also 5 miles of brick roads and 300 miles of roads which have not yet been surfaced.

Madison county has 4 miles of bituminous macadam, 2 miles built in 1911 at a cost of $7,500 a mile and has 5 miles of brick road, two built in 1911. About 25 miles of macadam and gravel roads will be built in 1912.

Pulaski county has about 50 miles of road under contract, four miles of macadam and the rest of gravel. There are about 15 miles up for action by the board of county commissioners, estimated to cost $28,000.

Vigo county has 2.5 miles of road made of coal cinders and 1.25 miles of brick.

Illinois has a population of 5,638,591, which is increasing over 15 per cent. per decade, and the 102 counties range in population from 7,000 to 120,000, not including Cook county, containing Chicago.

If the other counties in the state have been as active as those given in the table the mileage of gravel roads is now some 27,000 or more and that of macadam over 5,800.

It is probable that this is an under estimate, as the rate of increase for 1911 is much greater than this would indicate.

The cost of building roads is still somewhat low in Indiana, although almost every county shows an increase in cost in 1911 from the average cost given for 1904.

Indiana has a population of 2,700,876, which is increasing less than 10 per cent. per decade, and its 92 counties range from 4,000 to 264,000 population.

IOWA.

The Iowa State Highway Commission, under the law, originally passed in 1904, is composed of professors in the state college at Ames, Prof. A. Marston, dean of the division of engineering being the head of the commission and T. K. MacDonald, Ames, the state highway engineer. The appropriations are about $10,000 a year for the organization expenses.

There are 102,428 miles of road in the state, of which 2,504 have been improved.

The use of the road drag has been pushed in this state and a fund is now provided which can be used only for this purpose. The law is mandatory, but, as in Illinois, is difficult of enforcement. The greatest development in the state has been in the construction of concrete culverts and bridges, many thousands having been constructed in the past seven years. An automobile license law is expected to raise funds for road and culvert improvement. River to river highways have been quickly put into condition for travel but not all put into permanent condition.

The local roads are in care of county boards of supervisors averaging 3 or 4 members each and boards of township trustees of three each, who appoint not more than 4 road superintendents and one or more overseers for their respective townships.

Iowa has a population of 2,224,771, which decreased slightly during the last census decade, and its 99 counties range in population from 8,000 to 110,000.

KANSAS.

Kansas has a state highway engineer, W. S. Gearhart, of the state agricultural college at Manhattan, Kan., but makes no appropriations for road improvements, the expense of the office, $6,500 for 1911, being taken from funds appropriated for the college. No report of mileage of improved roads is available although the average cost of construction per square yard is said to be 50 cents for macadam, 25 cents for gravel and 70 cents for bituminous surfaces.

Local roads are in the control of boards of county commissioners of 3 each and the boards of commissioners of highways of the townships, of 3 each, which appoint overseers.

Kansas has a population of 1,690,949, which is increasing about 15 per cent. per decade, and its 105 countes range in population from 1,000 to 100,000.

KENTUCKY.

The constitution of Kentucky has been amended so that the legislature can now provide for improved roads, but little advance has yet been made.

The local roads are paid for from the proceeds of county taxes. The general condition may be judged by a report from Bourbon county which states that there are 375 miles of road in the county of which 350 miles are broken stone macadam, 2 miles being constructed in 1911 at a cost of $1,750 a mile. The width of this road is 14 feet, and its thickness 10 inches in the middle and 8 inches at the sides. It is paid for from a turnpike tax of 25 cents per $100. Madison county has about 400 miles of road of which 350 miles are broken stone macadam. Three miles of road were graded and drained in 1911, no new turnpikes being built. The county spends about $30,000 a year on its roads and bridges, reconstructing 1 to 25 miles of old turnpike each year with machinery, and keeping up the other roads by contract at about $8 per rod for hard metal spread on the roads. Dirt roads are worked 0y the neighboring labor paid out of an appropriation of $10 a mile. Many metal culverts, one large and several small iron bridges were built in 1910 and 1911.

The local roads are in charge of the fiscal courts of the counties, consisting of the county judge and 3 to 8 justices of the peace, who appoint a supervisor in counties under tax systems, and a bridge commissioner. Each county is divided into road precincts also and an overseer is appointed for each precinct.

Kentucky has a population of 2,289,905, which is increasing a little over 5 per cent. a decade, and its 119 counties range in population from 4,000 to 263,000.

LOUISIANA.

The roads of Louisana are under the state board of engineers with G. Lombard, New Orleans, the acting state highway engineer. Little has yet been done in applying the law of 1910 providing that the state shall pay half the cost of new roads, under which the appropriation for 1911 was $132,355. The highway fund will receive also the surplus revenues of the oyster and the fish and game commissions. Convict labor is also used on the roads. It is reported that only 1.32 per cent. of the roads of the state have been improved.

The local boards are in the hands of the police juries of the parishes (counties) of 5 to 10 members each, who divide their parishes into districts and appoint an overseer for each.

Louisiana has a population of 1,656,388, which is increasing about 20 per cent. a decade, and its 60 parishes range in population from 4,000 to 340,000.

MAINE.

The roads in Maine are in charge of the commissioner of the state highway depart-

ment, Parker L. Hardison, Augusta. The original form of the present law was passed in 1901. As revised in 1907 and amended in 1909, it provides for the selection of a state road by the county commissioners in each county so desiring, to be followed by the selection of others consecutively as they are in turn completed; for a state highway commissioner, assistant and office force; for state aid for the selected state roads, $2 for each dollar appropriated by towns having valuation of $200,000 or less and for unincorporated township and progressively less amounts for richer towns to 75 cents for each dollar appropriated by a town of $1,600,000 valuation. The state commissioner supplies plans and specifications and inspects before accepting work. Towns may bid for work as other bidders do. State may appoint inspectors to be paid from joint fund for road. Maintenance of state roads must be by towns to satisfaction of state commissioner. The tax to provide funds for the state's share is ¾ mill per dollar. Funds not applied for by towns may be used by state in establishing trunk lines.

The expenditures for state aid roads under the law was $666,789 prior to 1911 and the appropriation for 1911 was $250,000. Trunk lines took $39,780 of state funds prior to 1911, also private subscriptions of $24,910.

There are 25,528 miles of road in the state, of which 2,703 have been improved, 641 of them under the state aid provision and 8 under the trunk line provision. In 1910 the state aid construction amounted to 8.14 miles macadam, 6.58 miles tar macadam, 87.3 miles gravel, 0.18 miles granite block, 22.93 miles dirt road, 125.13 miles in all.

The average cost of building roads is reported to be 64.6 cents a square yard for macadam, 37 cents for gravel and $1.07 for bituminous pavements.

The local town expenditures on road construction and maintenance are estimated at $1,377,000 a year. The local authorities are the boards of county commissioners, 3 each, and in the towns 3 to 7 selectmen and a town road commissioner.

Maine has a population of 742,371, which is increasing over 5 per cent. per decade, and its 16 counties range in population from 18,000 to 112,000.

MARYLAND.

By the law of 1910 the roads of Maryland are now in charge of the state roads commission, of which Walter W. Crosby, Johns Hopkins Univ., is chief engineer. The state road law was first enacted in 1898, and state aid was first granted by an act of 1904.

The total amount of state aid funds expended prior to 1911 was $1,431,103 and the amount expended for trunk line roads was $6,853,728. The appropriations for 1911 were $200,000 for state aid roads and $1,050,000 for trunk-line roads. The state pays half the cost of the state-aid roads.

Convict labor is employed in crushing stone.

There are 16,773 miles of road in the state, of which 2,142 have been improved, 183 under state aid and 145 trunk line roads. The average cost of roads is reported to be 90 cents per square yard for macadam, 47 cents for gravel and $1.12 for bituminous surface.

During the year 1909, the latest for which there is a full report, there were constructed under the law 106.7 miles of macadam roads, 4.58 miles of macadam with surfaces treated with asphaltic oils, 7.92 miles of gravel roads, 0.79 miles of marl, 2.84 miles sand-clay, 9.02 miles of shell roads, making a total of 131.85 miles. The construction in 1911 used the natural soil or earth, unscreened and screened gravel, oyster shell, broken stone, both limestone and trap rock, vitrified brick, sheet asphalt and stone blocks, but the mileage of each is not reported. Some 250,000 gallons of pitch were used in constructing about 30 miles of these roads. The surfaces of previously completed ordinary macadam roads were also treated with pitch compounds of various kinds to the extent of 500,000 gallons of the pitch.

The development of the road system of the state is shown by the following table kindly furnished by Major Crosby:

Year	State Aided Roads, Miles	Baltimore Washington Road, Miles	Baltimore Annapolis Road, Miles	State Road System, Miles	Totals, Miles
1906 ..	23.25	.....	.....	.....	23.25
1907 ..	51.81	.....	.....	.....	51.81
1909 ..	112.99	18.57	.....	0.	131.56
1910 ..	140.91	18.57	.....	53.68	213.16
1911 ..	166.49	18.57	3.02	171.95	360.03
1912* .	12.10	5.39	10.18	159.33	187.00

* These figures show the length of road of each class underway on the first of January, 1912, which, when completed, will be added to the totals of 1911 to give the total mileage in the state which will then be about 550 miles in the state. About half of the 187 miles has been completed but not yet accepted.

Half the cost of state-aided roads is paid by the state, and the whole cost of the others in the table.

The total cost of this work to June, 1910, with estimate of cost of completion of contracts to 1911, thus giving the cost of the mileage in 1910 in the above table, is shown by the following from the final report of the Highway Commission of the Maryland Geological Survey on turning the highway system over to the new State Roads Commission:

Expenditures for construction of state roads, services, etc., including administration.....$	506,342.04
Paid by state to counties for state aid roads.....	495,113.73
Paid by counties as their share of state aid roads.....	511,202.74
Coutracts outstanding.....	271,550.00
Total cost of roads paid for in part or whole by the state....$	1,784,208.47

Maintenance of the roads is in the hands of the county authorities.

The local roads are under the boards of county commissioners of 3 or more members

each, who appoint a county road engineer and supervisors for each township.

The population of Maryland is 1,295,346, which is increasing less than 10 per cent. per decade, and its 24 counties vary in population from 10,000 to 558,000.

MASSACHUSETTS.

The roads of Massachusetts are in charge of the state highway commission of 3 members, of which Harold Parker is chairman and Arthur A. Dean is chief engineer, with offices in Boston.

The present law is very nearly the same as the original act of 1893. It provides for advice to local road officers and for state aid upon petition of the local authorities. When a petition is accepted the state takes control of the entire road. The town can take the contract for construction under the state specifications and inspection, but if not the state lets the contract and puts a resident engineer in control of the work. The state pays the entire cost, but one-fourth the cost must be repaid to the state within 6 years by the county in which the road is located. The roads are maintained by the state, but the local authorities can make independently temporary repairs when in danger of damages from accident or otherwise, although responsibility for such damages is transferred to the state. The town or city can take the contract from the state for keeping its roads in repair. The cost of maintenance up to $50 a mile a year is paid by the city or town, cost beyond $50 is paid by the state. Under the "small town act," the state may expend in any town of less than $1,000,000 property valuation, 40 per cent. of its own average annual appropriations for road purposes, and may fix the minimum at $400 per year, if the appropriation, which is 10 per cent. of the total state appropriation, will allow. Larger towns may receive a portion of 5 per cent. of the total state appropriation in case they make special appropriations in addition to the regular sums used, equal to the sums apportioned from the state funds. The state purchases rollers, crushers, etc., and loans them to towns of less than 12,000 population in addition to their use on the state's own work. Thirty-year bonds are issued by the state to raise funds from which to make its appropriations. Maintenance appropriations are made annually from current revenues, since 1908, largely from motor vehicle licenses. Twenty per cent. of this license fund may be spent on local roads not yet under the state system.

Appropriations have been made as follows under the law:

CONSTRUCTION.

1894	$ 300,000
1895	400,000
1896	600,000
1897	800,000
1898	400,000
1899	500,000
1900	500,000
1901	500,000
1902	500,000
1903	*2,250,000
1907	*2,500,000
Total	$9,250,000

* Appropriations for 5 years, one-fifth to be spent each year, that for 1907 extending through 1912.

MAINTENANCE.

1903	$ 40,000.00
1904	50,000.00
1905	60,000.00
1906	*64,166.66
1907	100,000.00
1908	**232,628.00
1909	**410,000.00
1910	**530,672.22
Total	$1,487,466.88

* Appropriation for 11 months.
** Include amount available from motor vehicle fees fund.

Convict labor is employed in crushing rock and in road building.

There are 17,272 miles of road in the state, of which 1,073 have been improved under the state aid law.

Average cost per square yard of roads is reported to be as follows:

Gravel	4 in. thick, 11 cents
Gravel	5 in. thick, 14 cents
Macadam	
Local stone	4 in. thick, 39 cents
Local stone	5 in. thick, 50 cents
Trap rock	4 in. thick, 57 cents
Trap rock	5 in. thick, 74 cents
Bituminous	
Gravel	2 in. thick, 37 cents
Macadam	2 in. thick, 48 cents

Earlier reports of cost, averaging roads built from 1895 to 1907, show higher figures, the weighted average being $7,663 a mile of road or 91.6 cents a square yard with 6 inches depth at center and 4 inches on sides, principally trap rock and granite.

The rate at which roads are improved and the proportions of different kinds is indicated by the 1910 report, showing construction of 18 miles of macadam, 6.5 miles of macadam with asphaltic oil surfacing, 2.5 miles of macadam treated with tar by the penetration process, 14.75 miles of gravel treated likewise, 6 miles of gravel, 6.75 miles of sand and oil, a total of 54.5 miles. There were also 41 miles of small town road work done. Bituminous surfacing was applied to 219.3 miles of old roads.

The local roads are in the charge of boards of county commissioners of 3 members each, and of the town selectmen, 3 to 9 in number.

The population of Massachusetts is 3,366,416, which is increasing about 20 per cent. a year and its 14 counties range in population from 3,000 to 731,000.

MICHIGAN.

The Michigan road law was first passed in 1905 and has had some minor changes since. It provides for a state highway commissioner, the present incumbent being Townsend A. Ely, Lansing, with Frank F. Rogers as deputy. The county and township highway commissioners are required to attend an annual road institute and all of them as well as the road

district and the township overseers of roads may be required to made sworn annual reports answering questions of the state commissioner, under penalty for neglect. The highway commissioner disseminates information, provides outline plans and specifications and expert advice. Whenever a mile of road is improved under township or county authority, under plans asked from and furnished by the state commissioner, he allots funds from the state reward for roads at the rate of $250 to $1,000 a mile, according to the character of the road, as described in the law. Allotments are made in order of application as funds are available, not exceeding one mile a year in any one township and provided state reward roads already in use shall have been kept in repair.

The appropriations under the act have been $110,000 for 1909, $160,000 for 1910, $150,000 for 1911, of which $10,000 each year is for the expenses of the department. The total expended on state aid prior to 1911 was $510,000. This amounted to about 22.5 per cent. of the total cost of the roads built under state aid.

Convicts are employed in breaking stone and upon road work.

Of the 69,104 miles of road in the state 4,319 have been improved, 790 thereof with state aid.

In the year ending June 30, 1910, 199 miles were improved on which the state rewards amounted to $123,035. Applications for aid are more numerous than the appropriations can cover. In about a month in September and October, 1911, there were 165 applications for aid, aggregating nearly 175 miles.

The activities of counties may be estimated from the following county reports:

Genesee county had about 65 miles of gravel road and added 15 miles in 1911; 3¼ miles of macadam and added 6 miles in 1911 at an average cost of about $5,500 a mile, of which $1,000 was paid by the state and the remainder by the county. It is proposed to build about 10 miles of macadam road in 1912.

Grand Traverse county had 10 miles of gravel road in use and added 5 miles in 1911 at a cost of $3,000 a mile, of which the state paid $500 and the county the remainder. Under the county road law about $33,000 has been spent and $17,000 is asked for 1912.

Livingston county has about 1,000 miles of road. In 1911 there were improved 10.5 miles of road with gravel at a cost of $1,500 a mile, of which the state paid $500. These were built and paid for by the township commissioners. Nine townships in the county will build in 1912 from 1 to 3 miles of gravel road, aggregating 15.75 miles.

Wayne county built 28 miles of road in 1911, 21 of them being of concrete. The concrete roads cost $1.10 to $1.80 a square yard and roads are usually 15 feet wide. One road 3.236 miles long and 16 feet width, of concrete 7 inches thick and 4-foot gravel shoulders, cost $1.35 for roadway proper and $1.426 including grading, shoulders, etc. This is $13,426 a mile. The county has issued $2,000,000 bonds for building these roads.

The local roads are in charge of the board of county supervisors, one member from each township, except in counties adopting the county road system, which elect 3 road commissioners. The townships also have highway commissioners.

Michigan has a population of 2,810,173, which is increasing over 15 per cent a year, and its 83 counties range in population from 2,000 to 532,000.

MINNESOTA.

The state road law was established in 1905 and provided for state aid, one-third the cost of state aid roads being paid by the state and two-thirds by the county. Louis W. Hill, Minneapolis, is chairman of the state highway commission and George W. Cooley, Minneapolis, is secretary and state engineer.

The state funds are the proceeds of one-twentieth mill tax per dollar valuation and profits of internal improvement land fund.

The amount spent in aid of road building prior to 1911 was $280,940. The amount appropriated for 1911 was $19,300. The state has built about 10 miles of road in small sections at its own expense.

Convicts are used in crushing rock.

Of the 79,323 miles of road in the state 3,417 have been improved.

The cost of the roads built is reported to average 55 cents a square yard for macadam and 10 to 20 cents for gravel.

Activity varies greatly in various counties as may be seen from some sample reports.

In Jackson county state roads have been graded but not improved with macadam or gravel. No state aid was received in 1910 or 1911. The county appropriations of $9,835 were used in building bridges.

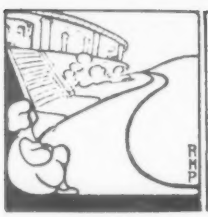
Lincoln county had 45 miles of graded roads to which 10 miles were added in 1911 at a cost of $500 a mile. Four miles of gravel road were built at a cost of $1,320 a mile. Almost $8,000 will be expended in road building in 1912.

Mahnomen county was organized in 1907, and is a wild prairie without improved roads. There are about 24 miles of state road, with 36 miles in prospect. Town roads measure probably 50 miles.

Renville county has 2,000 miles of road, of which 150 miles are of gravel and 2 miles of macadam. Reports for 1911 are not yet in.

Todd county has from 1,200 to 1,400 miles of road and macadamized one mile in 1911. The roads are nearly all built by the townships and poll taxes are worked out. Each of the 28 townships averages annual expenditures of $1,500 on roads.

The local roads are in charge of the board of county commissioners of 3 or 5 members and a county superintendent of highways, and of the town board of supervisors and a town road inspector.



ORGANIZATIONS & INDIVIDUALS

American Association for Highway Improvement—American Society of Municipal Improvement—American Road Builders Association—International Pure Water Association—International Fire Engineers—Technical Associations—Calendar of Technical Meetings—Technical Schools—Personal Notes.

Road Congress of the American Association for Highway Improvement at Richmond, Va.

Upon invitation of the mayor and the Chamber of Commerce of the city of Richmond, Commonwealth of Virginia, the first annual Road Congress of the American Association for Highway Improvement and its affiliated organizations will be held in that city, November 20-23, 1911.

The coming Road Congress will bring together the foremost engineers, road officials, traffic experts, legislators, railway officials, manufacturers, contractors, and agriculturists, who will devote their serious attention to the various and important problems of road construction, maintenance, and administration.

The purposes for which the American Association for Highway Improvement was formed and which may be said to represent the aims and purposes of the coming Road Congress are as follows:

To correlate and harmonize the efforts of all existing organizations working for road improvement; to arouse and stimulate sentiment for road improvement; to strive for wise, equitable and uniform road legislation in every state; to aid in bringing about efficient road administration in the states and their subdivisions, involving the introduction of skilled supervision and the elimination of politics from the management of the public roads; to seek continuous and systematic maintenance of all roads, the classification of all roads according to traffic requirements, payment of road taxes in cash, and adoption of the principle of State aid and State supervision; to advocate the correlation of all road construction so that the important roads of each county shall connect with those of the adjoining counties and the important roads of each State shall connect with those of adjoining States.

Honorary delegates to the Congress are the President of the United States, the Vice-President, the Speaker of the House of Representatives, the Cabinet, the United States Senate and House of Representatives, the Supreme Court, the representatives of foreign governments, the Governors of and Lieutenant-Governors of the States and Territories, the State highway officials, other state officials, the mayors of cities, the presidents of State and other universities and colleges, the officers and members of the American Association for Highway Improvement, the officers and members of the Touring C ub of America, the representatives of the press.

Official delegates are two state delegates from each Congressional district appointed by the governor of each state and territory, within which such district lies, three delegates appointed by the mayor of each city, five delegates appointed by each national or interstate organization concerned directly or indirectly with road improvement, two delegates appointed by each state or other university or college and by each agricultural college or experimental station, three delegates from each state Association for Highway Improvement, three delegates appointed by each State Board of Trade and Chamber of Commerce, three degelates appointed by each Chamber of Commerce, Board of Trade, Commercial Club, and Business Men's Association directly concerned in the work of road improvement

Any one desiring to attend the Congress can doubtless secure appointment as an official delegate in one of the classes named.

The President of the United States will deliver the principal address on the opening day of the Congress which will be known as "National Day." Other distinguished men of achievement will deliver addresses on that day, among them, Governor Mann, of Virginia, Dr. Walter Page, Editor of the World's Work, W. W. Finley, President Southern Railway Company, Gen. T. Coleman DuPont, who is presenting to the State of Delaware a $2,000,000 boulevard, Hon. J. Hampton Moore, President, Atlantic Deep Waterways Association, and Hon. John H. Bankhead, of Alabama.

The second day of the Congress will be known as "Highway Engineers and Con-

tractors Day" and will be devoted to the practical problems of road construction and maintenance. Mr. Haro'd Parker, Chairman of the Massachusetts State Highway Commission, will preside. A number of the leading engineers and contractors of the United States and Canada will present twenty minute papers on the subjects with which they are most familiar. Among them will be: W. A. McLean, Provincial Engineer of Ontario, Canada; W. W. Crosby, State Highway Engineer of Maryland; A. N. Johnson, State Highway Engineer of Illinois; A. H. Blanchard, Professor of Highway Engineering, Columbia University; P. St. J. Wilson, State Highway Commissioner of Virginia, and John A. MacArthur of MacArthur Brothers, New York. These papers will be followed by five minute talks by other leading engineers and contractors and the proceedings will be published later on as bulletins of the American Association for Highway Improvement.

At 3 o'clock on "Highway Engineers and Contractors Day" the Manufacturers of road machinery, apparatus and materials will hold a meeting for the purpose of effecting a permanent organization to cooperate with the American Association for Highway Improvement and to promote in general the progress of road improvement in the United States. It is expected that from seventy-five to one hundred of the leading manufacturers will be represented and an interesting program will be given.

The third day of the Congress will be known as "Road Users Day" and will be conducted under the auspices of the Touring Club of America. It will be devoted to a discussion of the varioues problems of traffic regulation, not merely from the standpoint of the automobilist, but from every other standpoint. Hon. James S. Harlan, member of the Interstate Commerce Commission and a Director of the Association, will preside. The address of welcome will be delivered by Mr. Preston Belvin on behalf of the State Automobile Association and will be followed by J. T. Palmatary, President of the Richmond Automobile Club. Many distinguished speakers will present different phases of the traffic subject among whom will be: Senator Swanson of Virginia; Hugh Chalmers of Detroit, Col Charles Clifton of New York, Howard D. Hadley of New York, and many others of note. Moving pictures showing effects of good and bad roads will add to the humorous and dramatic interest of the day.

The fourth day of the Congress will be known as "Association Day" and will be devoted to the work of the American Association for Highway Improvement, the various affiliated organizations and the great National Associations indirectly concerned in the movement for road improvement. Dr. Joseph Hyde Pratt, State Geologist of North Carolina and President of the Southern Appalachian Good Roads Association, will preside. In addition to the affiliated organizations, it is expected that representatives of such important organizations as the National Grange, Farmers' Union, Automobile Associations, the National Civic Federation, Mothers Congress, the Lincoln Memorial Highway Association, and other organizations of similar standing will be heard on that day.

Tours of automobilists are beng arranged under the auspices of the Touring Club of America from all the principal cities of the country to the Road Congress.

The Capital Highway Association, under the able leadership of Leonard Tufts, is arranging tours over the Capital Highway route from Atlanta to Richmond. Mr. Tufts announces that cars will leave Atlanta in time to reach the Congress by November 19. The Association will hold its convention in the parlor of the Jefferson Hotel on the afternoon of the second day of the Congress, beginning at 3 o'clock.

Howard D. Hadley of Plattsburg, N. Y., and George A. Simard of Montreal, Canada, who are promoting a great highway from Quebec to Miami, Fla., will organize tours of automobilists from Quebec, Montreal and northern New York points who will meet at Richmond the tourists coming up from Miami and southern points, and it is hoped that this will be the occasion for taking such steps as will insure the completion of this great international highway.

The Congress of the United States has appropriated $2,000,000 for a memorial to Lincoln. The Lincoln Memorial Highway Association is seeking to have the memorial take the form of a great highway. Two routes are suggested for the highway, one from Washington to Gettysburg and one from Washington to Richmond. At Richmond the advocates of a Lincoln Memorial Highway will be heard and the Congress may be expected to make some definite action in regard to this important matter.

A more appropriate place than Richmond for the assembling of the first Good Roads Congress, under the auspices of the American Association for Highway Improvement, could not have been selected. The great undertaking of the Quebec-Miami Road, practically assured as far as Washington, D. C.; the project of the Capital Highway Association for a highway through the capitals of a number of Southern States, and the suggestion that the Lincoln Memorial, provided for by a Federal appropriation of $2,000,000 shall take the form of a national highway from Washington to Gettysburg, or from Washington to Richmond, pointed to Richmond as an eminently suitable forum for the discussion and exploitation of these several projects which may become object lessons in the construction of national highways.

Being conventinetly situated on the Atlantic seaboard to the middle west; the portal through which the people of the two great

eastern sections of this country, the North and the South, pass in their social and commercial relations; and the border city of the South, which, it is conceded, will be the scene of unsurpassed material development in the near future, presenting the greatest field for good roads improvement, Richmond logically offers the opportunity for successfully inaugurating the propaganda of the Highway Association.

Other considerations will render Richmond a convenient and attractive city to delegates and tourists.

Governor Mann of Virginia has issued a proclamation calling attention to the Road Congress and designating the week immediately preceding it as "Good Roads Week." He will urge in his proclamation that civic organizations, public schools, churches and all other influential agencies for the public welfare devote special attention to the subject of road improvement during that week.

Richmond is celebrated not only for its hospitality but for the incomparable manner in which this hospitality is extended to its guests. Preparations are beng made for a brilliant series of social events to occupy the evenings during the continuation of the Congress.

The official headquarters of the Road Congress will be at the Jefferson Hotel on Main, Franklin and Jefferson Streets, west. Delegates and visitors will find the registration room on the office floor of the hotel. The meetings of the Congress will be held at the auditorium of the Jefferson Hotel.

The Southern Railway, the Chesapeake & Ohio Railway, the Seaboard Air Line, the Atlantic Coast Line and the Richmond, Fredericksburg & Potomac Railroad enter Richmond. Arrangements are now under way to secure reduced round trip rates to Richmond. Delegates and visitors should consult their local or general passenger agents for details as to routing, rates, etc., or write to the office of the American Association for Highway Improvement at Washington.

Logan Waller Page, Director, U. S. Office of Public Roads, is President of the Association, W. C. Brown, President New York Central Lines, is Vice-President, Lee McClung, Treasurer of the United States, is Treasurer, J. E. Pennybacker, Jr., is Secretary, with offices in the Colorado Building, Washington, D. C.

The affiliated organizations include the Ohio Good Roads Federation, Western Michigan Development Bureau, Gulf Coast Good Roads Association, Aroostook County Good Roads Associaion of Maine, Montana Society of Engineers, Arkansas Good Roads and Drainage Association, North Carolina Good Roads Association, Memphis-to-Bristol Highway Association, South Carolina Good Roads Association, International League for Highway Improvement, Good Roads Club of Georgia, New Santa Fe Trail Association, Indiana Association for Highway Improvement, Iowa Goods Roads Association, Southern Appalachian Good Roads Association, Central Highway Association, Capital Highway Association, Touring Club of America, Tennessee Association for Highway Improvement, Omaha-Denver Goods Roads Association, Inter-Mountain Goods Roads Association, Oregon Association for Highway Improvement, Southeastern Kentucky Good Roads Association, Knox County Good Roads Association, Washington-to-Bristol Highway Association, Mothers Congress, North Dakota Good Roads Association, Virginia Road Associations, Manufacturers Committee.

The principal hotels are the Davis, Jefferson, Lexington, Murphy's, Richmond, Stumpf's.

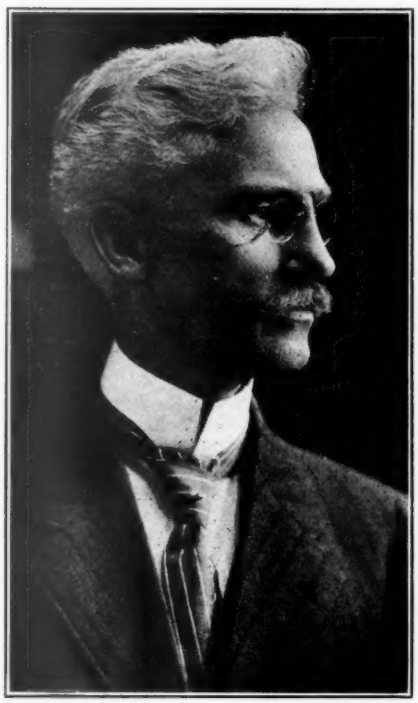
The Road Congress will open each day at 9.30 a. m. The afternoon sessions will begin at 3 o'clock.

American Society of Municipal Improvements.

The eighteenth convention of the American Society of Municipal Improvements at Grand Rapids began according to program with the meeting of the committee on standard specifications on Monday, Sept. 25 at 10 a. m. Three sessions on Monday two

E. A. KINGSLEY, President, Little Rock, Ark.

on Tuesday and brief sessions on Wednesday and Thursday noons were required to cover the discussion of the sub-committee reports presented and pass them to the society, and one, that of wood block was postponed for another year on account of inability to agree upon a report. The plan followed in these discussions is outlined in



B. E. BRIGGS, Vice-President, Erie, Pa.

the editorial department on a previous page.

The Society sessions proper began Tuesday at eleven with the usual preliminaries and official reports and the afternoon was devoted to a trolley ride about the beautiful streets and parks of Grand Rapids.

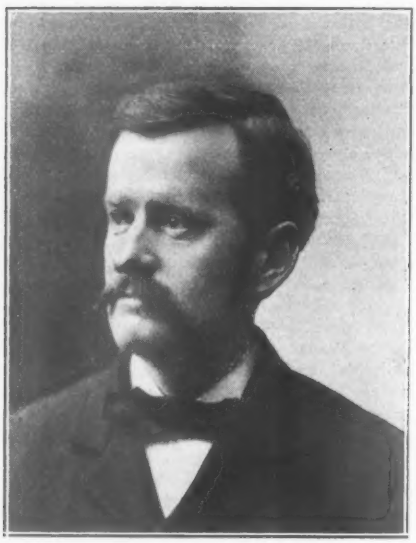
The real business of the convention began with the evening session and continued with two sessions a day until Friday noon. The program sustained the reputation of this society for high quality and included the following papers and reports:

"Maintenance and Development of Parks" by H. S. Richards, South Park Commission, Chicago; one on municipal methods by W. C. Meyer in charge of statistics of cities in the U. S. Census Bureau; "Bituminous Concrete Pavements" by H. G. Lykken, city engineer , Grand Forks, N. D., with a discussion by Geo. C. Warren, Boston, Mass., abstracts of which will be found on pp. 345 and 349 of this number; "Notes and Queries on Grouted and Sand Filled Brick Pavements" by Maury Nicholson, city engineer, Birmingham, Ala.; "Some Observations in Matters of Contraction and Expansion of Vitrified Brick Street Pavements" by Will P. Blair, secretary of National Paving Brick Manufacturers' Association, these two papers to be found on pp. 269 and 273 of the October number of MUNICIPAL ENGINEERING; "Asphalt Cements for Sheet Asphalt Pavements" by J. W. Howard, consulting engineer, New York City, which is given on p. 342 of this number. Special attention is called to the valuable table in this paper and to the general conformity of the standard specifications for asphaltic cements adopted by the society with the results of the tests of good cements shown in the table; "Bitucrete" by A. E. Schutte, Boston, Mass., which will appear later; "Municipal Water Purification Plant of Grand Rapids" by Geo. W. Fuller, consulting engineer, New York city; "Sewage Disposal" by Langdon Pearse, Chicago Sanitary District; "Some Examples of Ornamental Street Lighting" by Jos. E. Putnam, assistant city engineer, Rochester, N. Y.; "The Sanitation of Swimming Pools" by Melville C. Whipple and John W. M. Bunker; "Rebuilding of a Brick Sewer" by Edward S. Rankin, engineer of sewers and drainage, Newark, N. J., which was printed on p. 284 of the October number of MUNICIPAL ENGINEERING.

Reports of committees on garbage disposal, park maintenance and development, municipal legislation and finance, municipal data and statistics, street paving, traffic on streets, water works and water supply, sewerage and sanitation were presented.

The reports of the committee on standard specifications and of its sub-committees on brick paving, wood block paving, bituminous paving nomenclature, asphalt paving, and sewers occupied the greater part of two sessions of the convention in addition to the time in open committee meetings above described.

E. H. CHRIST, Vice-President, Grand Rapids, Mich.



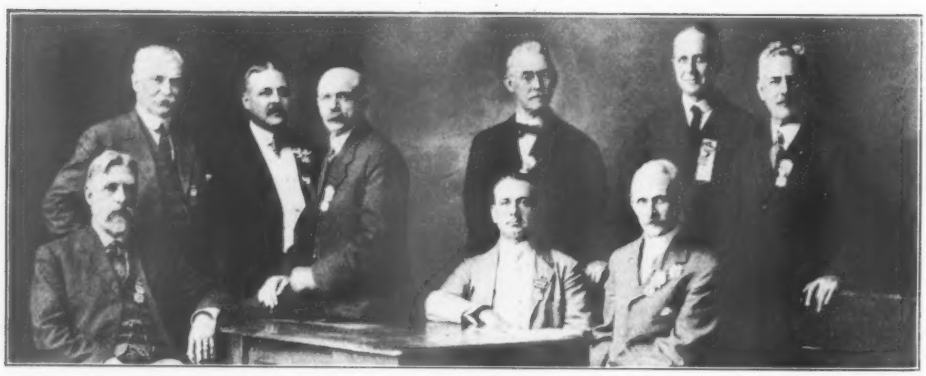
W. B. HOWE, Vice-President, Concord, N. H.

The city of Grand Rapids was lavish with its entertainments for members and their ladies. The banquet of Wednesday evening and the inspection of municipal work on Thursday morning deserve special attention. The latter included the new water works pumping station and electric light station, the latter not yet completed, the filtration plant under construction, sewage pumping plants, station for dumping garbage into cars, flood walls, and miles of first class brick pavements, bitulithic, asphalt, and some wooden block and the newer bituminous surfaces for streets.

The accompanying photograph of nine presidents and past presidents of the society shows the permanence of the membership, notwithstanding frequent changes in official positions, and the interest which the members continue to show in the society by attending its conventions. In order from right to left the record of these ex-presidents, members ex-officio of the executive committee, is as follows, beginning with those standing: George W. Tillson, consulting engineer for Brooklyn, N. Y., became a member in 1896, was secretary of the society 1901 to 1907 and was president in 1908. Morris R. Sherrerd, chief engineer, Newark, N. J., became a member in 1896 and was president in 1907. Charles H. Rust, city engineer, Toronto, Ont., became a member in 1898 and was president in 1903. Edwin A. Fisher, city engineer, Rochester, N. Y., became a member in 1896 and was president in 1902. Charles Carroll Brown, consulting engineer, Indianapolis, Ind., became a member in 1895 and was president in 1906. Fred Giddings, C. E., Atchison, Kan., became a member in 1896 and was president in 1911. James Owen, consulting engineer, Newark, N. J., became a member in 1904 and was president in 1909. Edgar A. Kingsley, consulting engineer, Little Rock, Ark., became a member in 1908 and is the president for 1912. A. Prescott Folwell, editor, New York city, became a member in 1901 and was president in 1905 and is the present secretary.

The election of officers moved the vice presidents up one step and made E. A. Kingsley, Little Rock, Ark., president, B. E. Briggs, Erie, Pa., Edward H. Christ, Grand Rapids, Mich., and W. B. Howe, Concord, N. H., vice presidents. A. Prescott Folwell and E. S. Rankin were continued as secretary and treasurer.

Dallas, Tex., was selected as the next place of meeting.



PRESIDENT AND PAST PRESIDENTS OF AMERICAN SOCIETY MUNICIPAL IMPROVEMENTS .

American Road Builders' Association Meeting at Rochester, N. Y.

The preliminary circulars of the congress to be held by the American Road Builders' Association at Rochester, N. Y., Nov. 14 to 17, are devoted to the names of state governors and the delegates they have appointed to the congress and to the names of applicants for exhibit space. The program is reported as not yet completed, but, to judge from previous conventions, should be well worth hearing. No local arrangements are announced, and the only reduced rates are in the territory of the Trunk Line Association. Harold Parker, chairman of the Massachusetts Highway Commission, is president, and E. L. Powers is secretary.

The International Association of Fire Engineers.

The thirty-ninth annual convention of the International Association of Fire Engineers, held in Milwaukee on September 19-22, was unanimously voted to be the greatest ever held from the standpoint of attendance and educational value. Six hundred fire chiefs from all parts of the United States and Canada were in attendance, and were entertained between business sessions by the citizens of Milwaukee.

Automobile fire machinery was the chief topic discussed in the convention hall and hotel lobbies. There were thirty-seven pieces of motor-driven apparatus shown in the exhibition hall, consisting of chief's cars, combination chemical and squad cars, hook and ladder trucks and gasoline fire engines. The largest piece shown was a two-hundred horse power Knox truck, with a huge pump carried amidship, which is driven by the same engine that propels the vehicle.

W. H. Loller, chief of the Youngstown, O., fire department was elected president, and Denver was selected as the next place of meeting. Other officers elected were: First vice-president, H. F. Magee, Dallas, Tex.; second vice-president, Thomas Haney, Jacksonville, Fla.; secretary, James McFall, Roanoke, Va., re-elected; treasurer, George Kloflock, Mansfield, O.

Technical Associations.

At a regular meeting of the Brooklyn Engineers Club on October 12, William J. Grinden presented a paper on "All Metal Construction of Doors and Trim for Fire-proof Buildings."

Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment of New York City, presented a paper on "The City Plan and What It Is," before the regular meeting of the Municipal Engineers of the city of New York, held on September 27.

Among the topics discussed before the fourteenth annual convention of the National Firemen's Association, held in St. Louis on September 25 to 27, were the following: "Fire Apparatus, Past, Present, and a Glimpse Into the Future" by Ex-Chief Geo. C. Hale, Fire Commissioner, Kansas City, Mo.; "Should Not the Chief of the Fire Department be Consulted and Apprised of all Building Permits and Have Power to Compel the Cleaning up and Building of Stairways, Elevators, Etc"; "Are Not Firemen the Poorest Paid Employees of the Municipality, Duties Considered?" by Capt. Wm. Roth, Rochester, N. Y.; "Is the Revolving Gear or Rotary Style Pump, or Reciprocating or Vertical Type, as used on Steam Fire Engines, Best Suited for the Motor Driven Apparatus of the Day, from the Points of Simplicity of Construction, Economy of Operation and Durability of Machine?" by M. M. Thos. M. Robinson, Washington, D. C., Chairman Topic Committee; and "Solid vs. Pneumatic Tires on Motor Driven Apparatus from Points of Speed, Safety and Economy" by T. E. Smith, Akron, Ohio.

The permanent International Association of Road Congresses has issued the first number of its periodical bulletin. This issue contains the minutes of the proceedings of the permanent International Commission, a number of abstracts of papers given before the recent Brussels conference, and other contributions.

The official report of the conference of the State Immigration officials, held in Chicago on July 24-26, 1911, has been issued by A. B. Hulit, Commissioner General, 10 E. Jackson Boulevard, Chicago, Ill. It contains an outline of the purposes of the organization, which are primarily to encourage the "back to the farm" movement, and to provide an instrument for bringing the man and the land together.

At a regular meeting of the New York Electrical Society held on October 27, Maj. George O. Squier of the U. S. Signal Corps, presented a paper on "Electric Waves Directed by Wires for Intercommunication Purposes."

C. A. Crane, secretary of the General Contractors Association, gave an illustrated paper on "The Contractor's View of City Contracts and Specifications," at a regular meeting of the Municipal Engineers of the City of New York.

Municipal control of water works was the principal topic of discussion at the sixteenth annual convention of the Pennsylvania Water Works Association, which met in Atlantic City on October 18-20. L. E. Chapin, consulting engineer, Pittsburg, Pa., delivered an address on "The Conservation and Storage of Water," and an address on "Municipal and State Control of Public Utilities" was delivered by J. H. Purdy, also of Pittsburgh. Among the other speakers were Edgar Munson, of Williamsport, Pa., who spoke on "Appropriation of Water Under Pennsylvania Statutes," and J. M. Chester, of Pittsburgh, who took as his topic "Water Companies vs. Insurance Companies."

The Board of Trade of Newark, N. J., is

taking an active interest in the questions of civic betterment. Among the papers presented at a banquet of the organization held on October 18, were the following: "First Need of City Planning," by David Grotta; "Public Welfare and Public Safety," by Dr. R. G. P. Dieffenbach; "Transportation and Traffic," by Joseph H. Wood; "Municipal Administration," by J. Harry Bacheller.

A special meeting of the Cleveland, O., Engineering Society was held September 26. A paper on "Smoke Prevention," was presented by Paul P. Bird, of the Commonwealth Edison Company, Chicago, formerly Chief Smoke Inspector of Chicago.

At a regular monthly meeting of the American Society of Engineering Contractors held in New York City on September 17, Myron H. Lewis gave an illustrated lecture on "Waterproofing as a Means of Insurance."

The first annual meeting of the American Society of Engineer Draftsmen was held at the Teacher's College, Columbia University, New York City, on October 3. Walter M. Smyth, 116 Nassau St., New York City, is secretary.

At the regular meeting of the Engineers' Club of St. Louis, held on October 4, Charles W. Martin, engineer in the bridge division of the St. Louis street department, presented an illustrated paper on "Methods of Reinforced Concrete Design."

At the regular meeting of the American Society of Civil Engineers, held in New York City on October 4, a paper, by Mr. Wilson Sherman Kinnear, entitled "The Detroit River Tunnel," was presented for discussion. This paper was printed in the August "Proceedings."

The National Builders' Supply Association have decided to hold their next annual Convention in New York City in conjunction with the Second Annual New York Cement Show on January 29 to February 3, 1912. The meeting of this organization in connection with the New York exhibition will mean a very large attendance of the building material interests from all parts of the United States.

At the recent meeting of the Central States Water Works Association at Cleveland, the following officers were elected: W. J. Scroggins, president; W. A. Veach, vice-president; R. P. Bricker, secretary, and A. W. Inman, treasurer.

Calendar of Technical Meetings.

National Municipal League.—Annual Meeting, Richmond, Va., November 13-16. Clinton Rogers Woodruff, secretary, 705 North American Building, Philadelphia, Pa.

American Road Builders' Association.—Annual Convention, Rochester, N. Y., Nov. 14-17. E. L. Powers, 150 Nassau street, New York, N. Y., secretary.

League of Nebraska Municipalities.—Annual meeting, Omaha, Neb., November 15-17. R. C. Ozman, secretary, Lincoln, Neb.

American Association for Highway Improvement.—First annual convention, Richmond, Va., November 20-24. Logan Waller Page, president, United States Office of Public Roads, Washington, D. C.; J. E. Pennypacker, Jr., secretary, Colorado Building, Washington, D. C.

New Jersey Sanitary Association.—Annual meeting, Lakewood, N. J., November 24-25. J. A. Exton, secretary, 75 Beech street, Arlington, N. J.

American Public Health Association.—Annual convention, Havana, Cuba, December 4-9. William C. Woodward, M. D., secretary, District Building, Washington, D. C.

Second Annual New York Cement Show.—Madison Square Garden, January 24- February 3, 1912. J. P. Beck, General Manager Cement Products Exhibition Co., 72 W. Adams street, Chicago, Ill.

Fifth Annual Chicago Cement Show.—Coliseum, February 21-28, 1912. J. P. Beck, General Manager Cement Products Exhibition Co., 72 W. Adams street, Chicago, Ill.

First Annual Kansas City Cement Show.—Convention Hall, March 14, 21, 1912. J. P. Beck, General Manager Cement Products Exhibition Co., 72 W. Adams street, Chicago, Ill.

Technical Schools.

President McLaurin of the Massachusetts Institute of Technology announced on October 10 that a 50-acre tract of land on the Cambridge side of the Charles River Basin, between the Harvard and West Boston bridges, has been selected for the new home of the college. This selection is contingent on favorable action by the Cambridge municipal authorities on closing certain streets. The property is stated to be valued at $750,000 and T. Coleman du Pont, of Wilmington, Del., is said to have agreed to furnish two-thirds of this amount.

Paul Hansen, State engineer of Kentucky, has been appointed associate in sanitary engineering at the University of Illinois and engineer to the Illinois State Water Survey. Prof. Edward Bartow is director of this survey, which has an appropriation of $20,000 for making a study of the water supplies of the State.

R. B. Kittridge has been appointed instructor in civil engineering at the University of Maine. A. T. Childs has been appointed assistant professor of electrical engineering at the same university.

F. C. Lincoln, M. Am. Inst. M. E., has been appointed Associate in mining engineering at the University of Illinois. For the past year Mr. Lincoln has been in practice as a consulting engineer in New York City, and he was formerly Professor of geology of the Montana School of Mines. He is a graduate of the Massachusetts Institute of Technology.

Langdon Pearse, of the Sanitary District of Chicago, delivered an illustrated lecture on "Sewage Disposal" before the Civil Engineering Society of Purdue University on Oct. 5. The work of the Sanitary District and the scope of the testing station were described.

L. D. Rowell, formerly Assistant Professor of electrical engineering at the Case School of Applied Science, has been engaged to take charge of the electrical laboratory

of Purdue University at Lafayette, Ind. He is a graduate of the University of Wisconsin, Class of 1901. A. D. Du Bois will have charge of the junior electrical laboratory under Mr. Rowell's direction. Mr. Du Bois is a graduate of the University of Illinois, Class of 1899, and has recently been an instructor at Cornell University.

Prof. Arthur H. Blanchard, professor of highway engineering at Columbia University, New York City, has issued a booklet describing the graduate course in highway engineering at that institution.

Personal Notes.

Charles H. Pieper, city engineer of San Jose, Cal., died in that city on Oct 1.

Chas. E. Hoover, Columbus, O., has been appointed chief chemist, in charge of the water purification plant.

Maurice E. Connolly, city magistrate of Queens, has been elected Boro President, to succeed Lawrence Gresser.

William H. Catlin, superintendent of highways of the State of New York, died at Port Chester, N. Y., on October 5.

Leo Hudson has been appointed consulting engineer of the borough of Duquesne, Pa., and will be engaged in matters in relation to the sewerage system.

Arthur H. Blanchard, M. Am. Soc. C. E., consulting highway engineer, formerly of Providence, R. I., announces the removal of his office and laboratory to Broadway and 117th street, New York City.

Mr. Herbert T. Salmonde has been appointed chemist and bacteriologist at the Mundale filters in Springfield, Ill. He has been recently connected with the Chicago Board of Health, as bacteriologist.

James E. Gibbons has resigned his connection with the New York Board of Water Supply, where he has been engaged on the Hudson River siphon and is now in charge of the work on the Fourth avenue subway in Brooklyn.

C. R. Young, lecturer in structural engineering in the University of Toronto, and late of Barber & Young, structural engineers, of that city, has opened on office as consulting engineer at 318 Continental Life Building, Toronto.

Wm. R. Benson, chief of the bureau of Highways and street cleaning of Philadelphia, Pa., with a salary of $6,000, has been dismissed by Mayor Reyburn for "disloyalty to the administration," as the result of a political disturbance.

Alfred Craven, M. Am. Soc. C. E., has been appointed chief engineer of the Public Service Commission of New York City. Mr. Craven had been acting chief engineer since the resignation of Henry B. Seaman, M. Am. Soc. C. E., in September, 1910.

Under a new administration in the city of Baltimore, Md., H. K. McCay has been appointed city engineer and Edgar B. Whitman named as water engineer. Mr. McCay has been recently associated with the McCay Engineering Company, of Baltimore.

O. H. P. Cornell, a civil engineer and son of Ezra Cornell, the founder of Cornell University, died at Winston-Salem, N. C., on October 13. He was a graduate of that university in the class of 1874, and had been engaged for a number of years in railroad work.

Alexander R. McKim, consulting engineer, New York, has been retained by the New York State Conservation Commission to conduct an inquiry into the condition of dams and reservoirs in the State for the purpose of taking such precautions as are necessary to eliminate danger of failure.

At a recent meeting of the Louisiana State Board of Engineering Examiners, at New Orleans, officers were elected as follows: Ira W. Sylvester, president; F. H. Waddill, vice-president; Mr. Marcel Garsand, secretary, and B. W. Peagues, chairman of the committee on examination papers. These are all re-elections from the last term of service.

Henry A. Young, Assoc. M. Am. Soc. C. E., formerly of the Jobson-Hooker Co., New York City, and Howard E. Hyde, Assoc. M. Am. Soc. C. E., formerly engineer in charge of designs of the Havana, Cuba, sewerage and drainage systems, have formed a partnership for the practice of civil and sanitary engineering with offices in the Produce Exchange Bldg., New York City.

Wm. R. Copeland has resigned as chemist in charge of the water-purification plant at Columbus, Ohio, and on Oct. 1 began service with the Metropolitan Sewerage Commission of New York (17 Battery Place, New York City), where he will have the title of chemist. He will have charge of investigations which are being made by the Commission to throw light on the capacity of New York Harbor to assimilate sewage without offence.

Dr. N. C. Ricker, Professor of Architecture, and Professor I. O. Baker, in charge of the Department of Civil Engineering of the University of Illinois, have been appointed by Governor Deneen as members of the Commission to Revise and Codify the Building Laws of the State of Illinois, which Commission was authorized by the last General Assembly of the State. The other members of the Commission are Mr. R. E. Schmidt, Mr. W. C. Armstrong and Mr. W. S. Stahl of Chicago, Mr. W. H. Merrill of Lake Forest and Mr. G. J. Jobst of Peoria. Dr. Ricker is Chairman of the Commission.

The firm of Wannenwetsch and Company, composed of C. H. A .Wannenwetsch, A. C. Lembke and R. T. G. Liesinger, doing a general architectural and engineering business, has been dissolved by mutual consent. Charles H. A. Wannewetsch has formed a partnership with his brother, Andrew T. Wannenwetsch, under the firm name of C. H. Wannenwetsch and Company, to engage in the general architectural and engineering business and to manufacture sanitary rendering and drying machinery and apparatus together with other packing house and reduction machinery, with office in Citizens Bank Bldg. at No. 563 William Street, Buffalo, N. Y.

Walter Herbert Sears, for about five years chief engineer of the Aqueduct Commissioners, in charge of the extensions of the Croton water supply of the city of New York, died Oct. 7 at his home in Plymouth, Mass. Mr. Sears was born in Plymouth, in 1847, and graduated from the Massachusetts Institute of Technology in 1868. In 1904 he became division engineer of the Croton River Division of the Aqueduct Commissioners and had charge of work in the vicinity of Katonah, N. Y. From August 1, 1905, to January 9, 1906, he was acting chief engineer, and from the latter date to April 1, 1910, chief engineer of the Aqueduct Commissioners. During this period the Cross River reservoir was completed and the Croton Falls reservoir construction begun and carried nearly to completion.

MACHINERY AND TRADE

Ornamental Street Lighting in Warren, Ohio.

The business district of Warren is at the present time lighted by 86 ornamental standards, two of which are of the five light cluster type, the top one being 80-watt and an all-night lamp, while the remainder are 40-watt lamps burning until midnight. Along the park side of two of the business streets are 22 single-light standards, four of which are equipped with 50-watt lamps, which burn all night; and 18 of which are equipped with 60-watt lamps that burn until midnight. On the opposite side of the business streets are 62 three-light standards, of which the top lights on fifty-one burn all night, the pendants of these fifty-one being turned off at midnight, while the top light and pendant lights of the other eleven are extinguished at midnight. The ornamental standards in the business district are equipped as follows:—top lights are enclosed in 14-inch Alba glass ball globes and the pendants in 12-inch ball globes. The absorption of these globes is specified to be a maximum of 15 per cent.

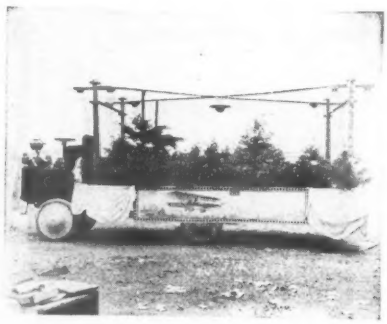
The metal posts are of charcoal iron, the column being of Corinthian design, with Doric top, while the base is a cast iron square, anchored to a 2½ ft. cube of concrete. The cross arms are at right angles with the curb line, and are of 36-inch spread.

All single light standards are made and wired so as to permit attaching cross arms later similar to the three-light standards and, as above stated, the one-light standards are all placed on the park side of the business streets, while the three-light standards are on the business side of the streets.

All ornamental standards are connected through an underground system and in the park and such other places where it was not necessary to take up pavement, the wires are laid in a lead covered cable, armored with steel tape, wrapped with jute and compound. In places where it was necessary to take up pavement a 2½-inch fibre conduit was laid immediately below the foundation of the pavement and enclosed in concrete. Through this conduit was drawn the usual lead covered cable.

The spacing of the ornamental standards in the business districts varies from 65 to 80 feet, according to the requirements of the street, each street having a uniform spacing. This arrangement gives a candle power per lineal foot varying from 3.4 c. p. to 4.2 c. p. per lineal foot of street. Street intersection lighting is arranged by placing the ornamental standards at the point of intersection of the street line extended and the curb line, thus providing ample lighting for all cross walks. The center of the standard is set back 18 inches from the face of the curb lines, thus bringing one pendant lamp over the curb, and the other over the sidewalk. This uniform alignment gives a pleasing effect.

The residential district is provided with all-night service. The spacing on the street varies from 115 feet to 300 feet between the lamps. There are installed 211 80-watt lamps, 90 60-watt lamps, and 355 40-watt lamps. Main thoroughfares are favored in the closeness of spacing and the candle power of lamps. The overhead wiring system is followed in the residential district. Lamps are installed along the same side of each street, giving a continuous line of lighting, the plan followed being first to place a light at street intersections thus giving double efficiency at such points. Intermediate lights between street intersections are placed at equal distances, care being taken to have spacing on each street uniform. Goose neck brackets attached to wood poles is the plan of suspension of the lamps in the residential



STANDARDS FOR ORNAMENTAL LIGHTS IN WARREN, OHIO.

districts. Radially fluted steel enameled reflectors 18 inches in diameter are placed over each of these lamps. Unnecessary duplication of poles is avoided by using poles of telephone, telegraph, and other companies where premission could be secured to do so.

A recording ammeter is located on the main feed wire of the municipal lighting system, and a meter record is kept and furnished the city council quarterly, the same being used as a basis of paying for the service; although the basis of the contract is a flat rate per lamp per year. Every street in the city is lighted to the corporation limits. The full amount of $13,000 paid by the city for this new lighting system is cut down somewhat by revenue received from the railway companies for the lighting of railway crossings, by virtue of a law in the State of Ohio.

The old lighting system which was superseded by the tungsten installation consisted of 161 open arc Brush lamps of 9.6 amperes. The operation of this system up to midnight with a few all night lamps cost the city $10,800 per annum, while the new lighting system, using the Mazda tungsten lamps, and giving all night service all over the city, costs $13,000 per annum. Twenty per cent. of the streets are lighted by this new system than were lighted before, while the streets formerly lighted by the arc lamps are now illuminated better than by the former method. The kilowatt consumption under the new method is thirty per cent. less than by the old method.

The installation of the new ornamental system was made by the Sterling Electrical Manufacturing Co. of Warren, O.

The accompanying photograph shows the type of standard adopted and gives some idea of the system. The float is one of a number which appeared in a festival parade held in celebration of the completion of the lighting system.

Calcium Chloride in Road Construction.

Calcium chloride has the properties of a sponge, and will absorb and carry large quantities of water; this absorption is rapid, but the evaporation is slow, so slow that a treated roadway will keep the dust down ten times as long after a rain or wetting as it will stay down on an untreated one. The chemical gathers moisture from rain, frost, damp air or dew, and with a normal fall of dew will gather moisture each night to keep the road in good condition the next day, even when the full absorption of a rain has been evaporated; but, like the sponge, it will dry out, in long and excessive dry spells, and must have an artificial wetting if perfect conditions are desired. It also has the characteristics of the leech and will attach itself to any porous substance it may be on or against, at time of saturation, and like the leech, once attached is removed with difficulty. Though soluble in water, the chemical used on this road work is 80 per cent heavier than water and so can not lift and flow with it. This ensures a long and continuous service, in fact a large part of the chemical will carry over from year to year.

The construction of a road by the use of calcium chloride differs but little from the ordinary gravel or macadam construction. A base of 4 to 6 inches is provided and compacted so that the voids are entirely filled. Upon this base is spread a layer of sand using a cubic yard of sand and 75 lbs. of the calcium chloride, which are thoroughly mixed together by turning as in mixing concrete. Then spread same about 6 inches deep, and dump on to it 1½ cubic yards of screened half to one-inch gravel or crushed stone (don't use stone screenings as a filler, as the chemical will not mix with them as well as with sand); then cut and tumble this until the sand is filled into the voids; the dampness of the sand will cause it to hold its place in the stone voids. Spread this 3 to 4 inches thick, and if convenient roll it, if not let the traffic over it pack it. In this case it will be necessary to work the top a little with a rake or scraper, pushing the displacements back until the road is well ironed down with this traffic; but this can generally be done cheaper than the road can be rolled, and once it is packed this way it is there for all time. If any soft spots or depressions develop, simply fill on top until a bottom is found. This top sand, chemical and stone mix may be made and left anywhere for any length of time. If it has become dry from long exposure, simply throw on a few pails of water before spreading and compacting.

Surfaces used as railways, highways and by-ways, or walks, should be kept clear of weeds and all kinds of vegetable growths. The chlorides are vegetable poisons as well as dust layers, and so not only keep down the dust on the roadways, causing the top body of same to pack and remain firm and smooth, but they also so poison the soil composing these surfaces that a weed or vegetable will not grow on them, nor will seed germinate in them. Still the application of these chlorides in quantities sufficient to lay dust and kill weeds on the road surface will not injuriously affect or damage adjacent trees, shrubs, grass or flowers on the lawns.

The Howe Chemical Road Company of Detroit, Mich., have patented this process of road construction and are providing calcium chloride manufactured by the Saginaw Chemical Works, Saginaw, Mich., for use in this connection.

EIGHT MEN AT $14.00 A DAY PUMP THE SAME VOLUME AS

ONE GALLON OF GASOLINE IN THIS ENGINE DRIVEN PUMP.

An Economical Contractor's Pump.

The two photographs given herewith offer a graphical comparison of the old man power and the modern gasoline engine-driven contractors' pump. The power pump shown is one manufactured by the Harold L. Bond Co., 383 N. Atlantic avenue, Boston, Mass. The capacity of this pump equals that of the two diaphragm pumps shown. The cost of pumping in the case of the hand pumps was eight men at $1.75 each, or $14, as against one gallon of gasoline for the engine-driven pump. In addition to this factor of economy, the engine-driven pump may be operated continuously, requiring only occasional attention to renewing the gasoline and oil. A very conservative estimate places the saving of the gasoline pump over the hand pumps at $12 a day.

The gasoline pump is designed for use by

contractors or foundation, drainage or sewerage work. With this use in view, the engine has been made very simple in design, so that it may be readily comprehended by even unskilled laborers.

The engine has 3½-inch bore, 3½-inch stroke, and a normal speed of 500 revolutions per minute. Speed may be changed while in operation from 300 to 700 revolutions per minute without injury. This gives a speed to the pump from 30 to 50 strokes, as may be desired. The fly-wheel is 14 inches in diameter. The engine has jump spark ignition and Lukenheimer special generator valve.

The cylinder is cast in form of a sleeve, properly bored inside and machined outside, thus providing cylinder walls of uniform thickness. The water jacket and cylinder construction make the engine absolutely frostproof, and no serious damage can follow even though water was allowed to freeze solid in the water jacket. The engine is provided with a special speed regulating device which operates on the governor, by increasing the tension of the spring on the governor weight, and at the same time advancing the timing of the spark.

Every part of the engine is made to template, insuring interchangeability of parts. Each engine is thoroughly tested before shipment, and a record kept of its brake horse power delivered. The whole outfit is attached to channel iron frame, mounted on low cast iron wheels with swivel front axle and drawing handle. The batteries, coil and starting switch are in the battery box. The electrical equipment consists of six batteries and a jump spark coil in connection with a mica spark plug. The gasoline tank has a capacity of one gallon, sufficient for operating the pump eight hours.

The pump is fitted with a guaranteed diaphragm of best quality. It is a side inlet pump with connection for three-inch suction hose.

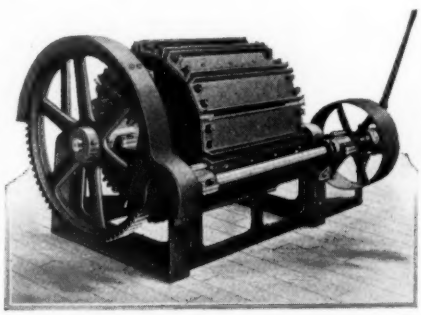
The Standard Brick Rattler.

The Ceramic Supply & Construction Co. of Columbus, Ohio, have placed on the market a brick rattler constructed exactly according to the specifications adopted by the National Paving Brick Manufacturing Association in 1911. A photograph of the machine is shown herewith. A full account of the provisions of the specifications has been given in these pages, but the following points in which the improved rattler differs from the old type may be noted.

The head of the rattler barrel is a regular 14-sided polygon inscribed in a circle 28⅜ inches in diameter. This head is provided with outward extending flanges to which may be fastened the staves which make up the sides of the barrel. The inner side of the head is lined with a cast iron liner one inch in thickness but only 28⅛ inches in diameter. This liner is fastened by seven screws fastened through from the outside. These liner plates are to be replaced upon becoming worn to a depth of ½ inch. They are constructed from a hard metal as hard as machinery iron and containing not less than one per cent. of combined carbon.

The staves are made of 6-inch medium steel structural channels 27½ inches long and weighing 15.5 pounds per lineal foot. The inner side of each channel is protected by a lining or wear plate ⅜ inch thick and 5½ inches wide by 19¾ inches long. The plates are constructed from medium steel and are riveted to the channel staves by 3½-inch rivets, the rivets being countersunk on the faces of the wear plates. It is provided that no set of wear plates shall be used for more than 150 tests.

As will be noted the provisions for replacing the barrel head and stave linings when they become worn, provide a constant volume within the barrel of the rattler; and therefore uniform conditions of test even though different machines are used. The driving gear and pinion on the Ceramic Supply & Construction Co. machine are protected by a safety device and a clutch is provided whereby the revolutions of the barrel may be stopped upon the required number of revolutions.



THE STANDARD SUPPLY AND CONSTRUCTION CO. STANDARD BRICK RATTLER.

W. D. Richardson, president of the Ceramic Supply & Construction Co. was chairman of the committee of the National Paving Brick Manufacturers' Association which drafted the original specifications for the standard rattler test in 1901. The company has made a specialty of the manufacture of rattlers together with screens, conveyors, elevating and power transmitting and other clayworking machinery. The fact that they specialize in this line indicates that they are particularly competent to make the standard rattler.

Spreading Dump Cars for Road Work.

One class of machinery to which little notice has been given, though it has been one of the most potential factors in road construction, is the "dump car" wagon, which has come into universal use on all large road contracts. The first of this type of carrier was a spreading dump car, invented and built by the Port Huron Engine and Thresher Company, of Port Huron, Mich., and used in the construction of a half mile sample stretch of road, built by the United States government. This was on the occasion of the first International Good Roads Congress, held in Port Huron, Mich. Since that time the spreading dump car has been developed to a high degree of perfection by its inventors.

The "1910 model" of the Port Huron spreading dump car is shown in the accompanying photograph. It is constructed of steel throughout, with broad wheels, which not only provide against cutting or rutting the subgrade, but, on the other hand, roll and compact the surface over which they pass, by reason of the front wheels being partly inside the back wheels, so that the total width of track is 20 inches.

Port Huron roller, with eight or a less number of cars, can be turned completely around without uncoupling or backing.

The cars are furnished either "spreading" dump or "full" dump, or both. The "spreading" dump provides for spreading crushed stone, gravel, etc., over the roadway, 1 to 8 inches deep and 4 to 4½ feet wide, according to the adjustment of doors, size of particles, evenness of ground, etc. The "full" dump type provides for opening the bottom and dumping all of the material at once. The bottom doors are set "crosswise" instead of "lengthwise," as in the case of the usual horse-drawn wagons. They have a carrying capacity of 7 tons, or 3¼ to 3¾ cubic yards, depending on the top box being level full or "heaped." Either horse hauling or engine drawing hitches are provided.

A train of the dump cars, hauled by a traction engine or road roller, is the most economical method for distributing road material. An extensive use of this sort of "train" hauling or road work throughout the eastern states has resulted in a saving of from $125 to $8,000 per mile of road built, over the old methods of hauling.

THE PORT HURON SPREADING DUMP CART.

The dumping levers are set low, so as to provide for their convenient operation by a man standing at the side of the wagon. The frame is of steel (channel sections being used) and is hot-riveted throughout to the steel body. The wheels are provided with roller bearings, lessening the tractive resistance of the car. The under-cut feature allows of the car turning clear, and the extended hitches allow it to travel outward and nearly on the track of the roller. A regular

A New Selling Company for Menzies Street Cleaning Company.

The Matchless Street Cleaner Company, Glen Falls, N. Y., now have the exclusive sale of the Matchless Sanitary Hand Cleaning Machines and Matchless Spring Steel Snow Shovels and the Menzies Street Cleaner company do not manufacture or sell the same. All inquiries and orders should be made to the Matchless Street Cleaner Company to insure prompt reply and shipment.

The Eclipse Low Charging Mixer on Bituminous Road Work.

The accompanying illustration shows one of the "Eclipse" low charging mixers driven by gasoline engine, all mounted on low-set truck, mixing "Tarvia" for road work in Rutherford, N. J. The contractors, P. & P. Jannarone, of Belleville, N. J., report having done this work very rapidly and with less expense than by other methods. The tar was melted in the usual way and poured into the drum from the platform which is shown in the illustration,, and thoroughly mixed with the crushed stone. The photograph shows two wheelbarrow loads of the mixed tar and stone as discharged from the mixer. The machine ran clear and worked rapidly without any trouble from the tar mixture hardening or caking around the blades. In order to keep the drum warm, so that it would not chill the tar, a sheet-iron fire box about 24 inches square and 12 inches deep was kept under the mixer drum with a small wood fire in it; and this answered all purposes and made a very cheap and effective outfit for this class of street paving work, and was entirely satisfactory to the contractor, as well as the engineer.

P. & P. Jannarone are now using the mixer for concrete on another class of street paving work. The manufacturers, The Standard Scale & Supply Co., 1345 Wabash avenue, Chicago, Ill., have recently closed some large and very desirable contracts for mixed equipments for bridge builders' use and on other classes of contracts.

MIXING BITUMINOUS CONCRETE WITH AN "ECLIPSE" MIXER.

A Municipal Garbage Incinerator and Steam Generator.

The Nashville Bridge Company of Nashville, Tenn., is at present constructing the first of a new type of incinerator and steam generator. This incinerator was invented and has been patented by J. B. Harris, M. D., who also invented the Harris Smokeless Furnace. It is claimed for the incinerator that it is odorless and smokeless and that it will provide sufficient steam for the operation of a municipal light plant of a size adequate for a town for which the incinerator is designed. The following are the essential features of the incinerator:

Four main drums or headers such as are used in Sterling boilers are set longitudinally; one large drum being placed in the center and connected by a system of pipes to two smaller drums in the same horizontal plane, and also to another large drum placed directly beneath it. The two smaller drums are connected to the lower or "mud drum." A baffle wall runs up back of the vertical pipes connecting the upper and lower center drums. A fire box equipped with a Harris smokeless furnace attachment is placed beneath and to one side of the mud drum. The path of the gases is as follows: The heated gases rise from the fire grate about the water pipes connected with the "mud" drum to one of the side drums and about the horizontal pipes from the side to the center drum. Thence they pass over the baffle wall and are deflected down about the other set of

horizontal pipes and also the diagonal pipes from the other side drum to the "mud" drum, and leave the furnace at a point but slightly above the charging door on the opposite side. A by-pass arrangement is provided whereby the gases may either proceed directly to the stack, or through a superheater connected with the upper center or "steam" drum.

The method of operation of the incinerator, as described, seems to provide for complete and odorless incineration. The material is dumped through a funnel-like hopper, which is made to revolve so as to distribute the refuse uniformly over the grate formed by the upper horizontal water tubes. Here it is dried by the hot gases which pass upward through the material on one side and downward on the other; this drying continuing until the refuse is dry enough to stoke through upon the diagonally placed tubes where the incineration proceeds. All materials, such as tin, old iron, scraps, etc., in the unpicked garbage are to be raked from the tubes before recharging.

Drainage is provided for by making the charging floor slope to a down pipe which will conduct the liquid down and through a pipe extending upward to a series of pans placed in a terrace like position with reference to each other. Here the greatest possible surface of liquid will be exposed to the hot gases leaving the furnace and evaporation will take place.

The roof of the incinerator is placed at some distance above the horizontal grate surface. The provision whereby both the upper and lower grates are placed in front of the bridge baffle wall, combined with the space provided over the upper grate are the features by which it is claimed the furnace will be operated without odor. It is stated that the sulphuretted hydrogen and other disagreeable gases, being lighter than the carbon dioxide products of combustion, will rise to the top of the furnace and there against the curved roof will be burned to sulphuric anyhdride plus carbon dioxide plus water which are without odor and heavier than the sulphuretted hydrogen, and will be discharged through the stack.

As for the steam generating efficiency of the plant, the following figures are stated by the inventor: "Figuring the two water drums of the boiler to be 16 feet from the center, the area of heating surface is 788 square feet, and all tubes and drums are designed to carry a gauge pressure of 150 lbs. At this pressure the boiler will carry a load of 1100 to 1200 horse power, and a garbage capacity of 150 tons."

The incinerator is to be built in units of 10 tons to 250 tons capacity per 24 hours, and generating from 100 h. p. to 1200 h. p. per unit. Further information may be obtained from J. B. Harris, M. D., 210 Stahlman Bldg., Nashville, Tenn.

A Durable Sewage Ejector System.

Trouble is often experienced in pumping sewage, by reason of the fact of the chemical action of the sewage and gases upon the moving parts of the pump, resulting as it does in the rapid deterioration of these parts. At the same time it is sometimes necessary, and often desirable, to raise the sewage, either by reason of bringing it to a high level trunk sewerage system, or because the grade line of the sewer must be changed.

The Priestman ejector system, manufactured by Merritt & Co., 117 North Front street, Camden, N. J., is an apparatus which provides for lifting crude unscreened sewage with the use of actuating mechanisms or machined surfaces in contact with the material pumped. The operation of the Priestman ejector system is briefly as follows:

Crude unscreened sewage is ejected by compressed air, automatically admitted when the ejector is full, and after a predetermined period being automatically cut off and expanding, while the remainder of the sewage is discharged.

Sewage gravitates into the ejector through a check valve, and in doing so expels the air contents of the ejector through the exhaust pipe to the atmosphere. When the sewage has risen about twelve inches above the mouth of the air bell in the ejector, the pressure of air in this bell, transmitted to the underside of a diaphragm, lifts it about one-eighth of an inch, opening a pilot valve and permitting a small quantity of air to pass from the air-supply main into the motor cylinder. This cylinder, being of larger diameter than the air-admission valve, the motor piston rises, closing the exhaust passageway and then opening a valve, which admits air to the ejector. Air pressure also passes to the upper side of the diaphragm, closing the pilot valve; and the exhaust valve is closed, the air pressure being exerted on the motor piston of that valve. The air is admitted to the ejector for a predetermined interval of time, which is adjusted to afford the highest working efficiency in each installation. The air within the ejector expands and continues to displace the sewage contents until the pressure is reduced to less than that required to hold the exhaust valve to its seat. This valve thereupon opens, permitting the air to exhaust and the ejector to refill.

The system is furnished in capacities ranging from 50 to 2,000 gallons per minute, so that a size may be obtained suitable to any condition, ranging from a small plant suitable for manufacturing concerns who wish to connect to a high-level sewer, to the condition in which a city is obliged to raise the sewage at the point of discharge

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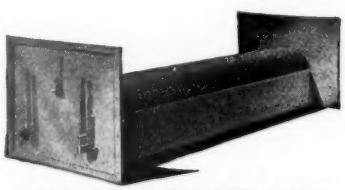
Collapsible Forms for Concrete Culverts.

The Concrete Form and Engine Co., of Detroit, Mich., are manufacturing collapsible culvert forms, which allow an arched

culvert to be constructed without the use of centering, and which may be easily withdrawn after the concrete has set.

These forms are made of 16-gauge galvanized steel covering, reinforced by steel on the inside. They are constructed in three pieces, the top (which is semi-circular) and two side plates. The photograph shows the form, set up complete, with end plates, ready for concrete. The working parts of the form are very simple and easy to operate. The top, set between the two side plates, is held in position by arms attached to the side plates by bolts which allow the arms to be lowered by pulling the draw-rods which are attached to them. By pulling the draw-rods the arms are lowered and the support of the top is removed allowing the top to be lowered. The side plates are held in position by swinging braces, so that when locked the sides are immovable. End plates are made which fasten to the top and side plates by keys so that they may be easily removed.

The first operation in the building of a culvert is the digging of a trench; this, if in hard earth such as clay soil, will not need boarding up, while in sandy soil planking must be used. The trench should be dug at least 4 inches deeper than the water level and this filled with grout and packed down. The width of the trench will depend upon the size of culvert form used and the thickness of the side walls, which we recommend to be eight to ten inches. The forms are then erected in the center of the trench, with the end plates on, and covered with grout. The grout extending to the top of the end plates will give a smooth face at each end of culvert over which the dirt from the roadway will not sift and stop the flow of water. This face



COLLAPSIBLE CULVERT FORM.

or abutment also prevents water from washing around sides of culvert as the face extends 10 or 12 inches beyond the culvert walls.. After the top is drawn the swinging braces are then unlocked and the side plates are easily removed. The culvert will last for years and costs about one-fifth the expense of a culvert constructed in the ordinary way. The forms are furnished for 12, 16 and 18-inch culverts and in 20-foot lengths. The forms are also adaptable to sewer work.

A Portable Asphalt Paving Plant.

A very complete asphalt paving plant, and one which is made for preparing the material "on the job," is being manufactured by the Continental Asphalt and Equipment Company, 1026 First National Bank Building, Chicago, Ill This plant comprises four units; namely, a power wagon for supplying current to the motors which operate the machine, two asphalt melting wagons and a machine for drying the stone and measuring and mixing the composition

The power wagon has a 67-h.p. gasoline engine driving a 45-k.w. electric generator which supplies current for four motors. Each asphalt melting wagon has a tank of 1,400 gallons capacity, heated by steam coils. The blocks of asphalt are laid upon a grating of steam pipes and gradually cut into smaller pieces and melted. Each set of wagons carries a small boiler fired by oil. The tank is fitted with a pump to force the melted asphalt into the measuring tank on the mixer machine for weighing.

The mixer wagon weighs about twelve tons. At the rear of the machine is a bucket elevator, by which the aggregate is delivered to a hopper feeding two sets of driers. Each drier consists of two superimposed revolving drums, fitted with blades. These are 24 inches in diameter and about 7 feet long. The upper drum is inclined 4½ inches in its length, and the material falling from it is delivered by a hood into the end of the lower drum, which has an inclination of 2 inches in its length. The drums are enclosed in a casing and are heated from the outside by means of oil burners. The temperature is about 1,500 degrees F. at the lower drum and 1,000 degrees at the upper drum. The material delivered from the lower drum falls to the boot of a second bucket conveyor, which elevates it to a charging hopper at the top of the machine for weighing; then it is discharged into the hopper below. The material from the drier may be discharged onto the ground, instead of going to the second conveyor, at the will of the operator. Each conveyor has a capacity of about 14 cubic feet per minute.

The two tanks for the dried aggregate and the liquid asphalt are on top of the machine; and proper proportions of the two materials are delivered into hoppers from which they are delivered by a chute and pipe, respectively, to a mixer. This mixer is one of the special features of the machine, the mixing being done in a closed revolving drum. This is, in fact, a concrete mixer adapted to its particular purpose.

This mixing machine has a steel frame work and is mounted on two pairs of wide-tired wheels. It was built by the Koehring Machine Company, of Milwaukee, Wis., according to the design of H. M. Kingsley, president of the Continental Asphalt and Equipment Company, 1026 First National Bank Building, Chicago, Ill.

The Fisher Concrete Block Meets Building Code Requirements.

The departments of public safety and the bureaus of building inspection in a number of cities have adopted regulations governing the use of concrete blocks for building purposes. It is conceded that the concrete block has not been entirely satisfactory as regards strength and imperviousness owing to the methods of manufacture, and at the same time the increased use of the material has made it necessary to place it on a par with brick and other construction materials and provide for its safe use. Baltimore, Md., Philadelphia, Pa., Duluth, Minn., Milwaukee, Wis., Detroit, Mich., and a number of other cities have adopted rules regarding concrete blocks and have incorporated these regulations in their building codes.

Detroit has recently enforced its code by testing the blocks manufactured in that city to determine the quality of the product that was being used. The Fireproofing Tile Company's concrete blocks were the only ones that could meet the tests required by the new code of the city. The Detroit Fireproofing Tile Co. are using a Fisher hydraulic ramming concrete machine and are operating the same to manufacture products such as dimension stone, trimmings, blocks, etc.

Official tests were made by the Detroit testing laboratory and these tests showed a crushing strength upward of 2000 lbs. to the square inch on an area of 9 inches and an absorption of less than 4 per cent.

Milwaukee has adopted a new ordinance for the use of concrete blocks in that city. The Roman Stone Co. of Milwaukee, after a careful investigation, conferring with the different manufacturers and users of machinery decided that only by the use of a wet mixing and ramming could a perfect concrete be produced, and are now installing one of the hydraulic ramming outfits purchased from the Fisher Hydraulic Stone and Machinery Company, 1109 Kilburn Ave., Rockford, Illinois.

An Automatic Dump Cart for Street Cleaning.

The Baker Manufacturing Company, 570 Hunter Building, Chicago, Ill., has a new type of light dump cart which is particularly adapted to street cleaning work. This cart, known as "The Witten," is of all-steel construction, making it very light and durable. The cart box is 2 feet by 4 feet by 16 inches deep, and is mounted upon the axle in such a manner as to balance the load evenly. In this way the weight of the load is not thrown upon the handles; and a fully-loaded cart may be propelled with as little effort as an empty wheelbarrow.

A simple releasing lock is provided, whereby the box is held firmly in position; but may be released and the contents dumped from the forward end of the cart without the workman leaving his position at the handles of the cart. This is provided by a system of levers connected with the end-gate at the forward end in such a manner that this end-gate rises as the box tilts forward, allowing the contents of the cart to be deposited upon the ground. By reason of its ease of operation the new dump cart is particularly adapted to street department work.

"Corinthian" Standards Chosen by the Government.

James Knox Taylor, Supervising Architect for the United States government has announced the selection of lamp standards and brackets in iron and bronze for various public works. The Flour City Ornamental Iron Works of Minneapolis, Minn., the manufacturers of the "Corinthian" ornamental lighting standard, were chosen out of eight competitors as complying with the specifications.

Trade Publications.

Voightman & Co., 445 West Erie street, Chicago, Ill., have a complete and fully illustrated booklet showing their line of metal windows. Line drawings, sections and photographs show the different types of windows and their methods of operation. Full directions are given regarding the installation of the metal panes according to underwriter's specifications.

"Storage Battery Cars" is the title of Bulletin No. 13, just issued by the Gould Storage Battery Company, 341 Fifth avenue, New York. This bulletin explains the economics of the storage battery car, describes the standard type made by the Gould Company and cites the conditions under which storage battery cars can be used most profitably. A copy will be sent on request.

The monthly publication of the Universal Portland Cement Company, Chicago, Ill., contains examples of concrete pavements, the Ashokan reservoir and road improvements, and some examples of concrete arch bridge and building construction.

Selling arguments for tin roofing are set forth in an illustrated booklet by the N. & G. Taylor Company, Philadelphia, Pa. It contains tables for estimating, instructions for laying and a description of the manufacture of roofing tin.

The "Kanawha" air pressure chemical fire apparatus is fully described in a booklet issued by the Kanawha Chemical Fire Engine Manufacturing Company, 74 Cortlandt street, New York, N. Y. The apparatus described makes use of a compressed air device for distributing a chemical solution.

Bulletin No. 36 of the Bates Machine Company, Joliet, Ill., describes and illustrates the new Bates inertia valve gear, which is now regularly applied to all Bates Corliss engines. This new gear has attracted much attention because of its quiet operation and the absence of hooks, springs and rollers.

The Bausch & Lomb Optical Company, Rochester, N. Y., has a very complete catalogue, descriptive of projection apparatus. This catalogue contains, besides interesting tables and data for reference purposes, a complete line of "Balopticons," or lanterns, by means of which photographs and natural objects may be projected upon a screen without first making lantern slides.

A short description and a very unique and interesting graphic outline serve to show the method of manufacturing Universal Portland cement. A booklet containing this matter may be obtained by requesting it from the Chicago office of the Universal Portland Cement Company.

The Warren Brothers Company, 59 Temple Place, Boston, Mass., has for distribution three interesting publications. The first of these, "Asphalt," by George C. Warren, deals with the origin and development of asphalt and gives some analysis for comparison of the different asphalts. The other two deal with asphalt paving plants; the one giving a full description of the larger or stationary plants, while the other treats of a portable asphalt and repair plant. Both are fully illustrated.

The Baker Manufacturing Company, 256 Madison street, Chicago, Ill., has a catalogue describing their "Twentieth Century" grader. The grader is particularly adapted to road improvement and maintenance, snow removal, pavement cleaning, and to the cutting of shallow ditches.

The William E. Dee Company, 108 North LaSalle street, Chicago, Ill., has a number of folders and leaflets which illustrate and describe the supplies manufactured and sold by that company. These include sewer pipe and specials, drain tile, cement coatings and waterproofings, cement, fire clay products and a full line of municipal castings.

A. Wyckoff & Son Company, Elmira, N. Y., has for distribution a reprint of a paper by T. Chalkley Hatton before the American Water Works Association, in Rochester, on June 7, 1911. The paper deals with wood stave pipe.

A direct connected Corliss engine and two types of direct current motors and generators are described in three new publications of the Allis-Chalmers Company, Milwaukee, Wis. These three bulletins, as is usual of the publications of the Allis-Chalmers Company, are complete in detail and fully illustrated.

The monthly bulletin of the Lehigh Portland Cement Company, Peoples Gas Building, Chicago, Ill., contains a short description, with photographs, of concrete bridge work on the A. C. L. railroad, the longest concrete highway bridge in the world, at Harrisburg, Pa., and a number of photographs of building work.

The American La France Motor Car Company, Elmira, N. Y., has an interesting collection of facsimiles of letters and newspaper comment on their motor fire apparatus.

The Terry Steam Turbine Company, 90 West street, New York City, has a bulletin describing its new non-condensing steam turbine and its applications.

Trade Notes.

Washington, D. C.—A correspondent in India desires one traction engine with sufficient power to drag 30 to 40 tons on level roads, 9 trucks of 10 tons capacity, one 10-ton steam road roller and a diagram of a pumping plant for wells, using gasoline and kerosene engines. Address Bureau of Manufactures, No. 7435.

Washington, D. C.—A report from an American consulate in Mexico states that a city is contemplating the purchase of street sweeping machines. Address Bureau of Manufactures, No. 7472.

Atlanta, Ga.—The MacArthur Concrete Pile and Foundation Company has been awarded a contract for the foundations of Fulton county court house, Atlanta, Ga. This building is to be a 9-story reinforced concrete structure, and is to cost in the neighborhood of $750,000. W. C. Spiker is consulting engineer.

Kankakee, Ill.—J. E. Pickens desires to purchase 2,400 feet of 8-inch and 6-inch pipe.

Hartford City, Ind.—The county commissioners are contemplating the purchase of a smoke consumer for the court house and jail.

New Orleans, La.—Bids will be received on December 7, at 3 p. m., for power equipment as follows: One 6,000-kw. horizontal high-pressure condensing steam turbine and alternating current generator, one 150-kw. rotary converter with stationary transformers, one 7-panel switch board. Certified check, $500. F. S. Shields, secretary; George G. Earl, general superintendent.

Buffalo, N. Y.—Special.—The Corrugated Bar Company has announced the removal of its headquarters from St. Louis, Mo., to Buffalo, N. Y., to occur on the fourteenth of this month. The company will occupy the third and fourth floors of the Mutual Life Building in Buffalo. The change in headquarters has been decided upon, as the stock warehouse and fabricating plants are located near Buffalo. District offices will be maintained in the National Bank of Commerce Building at St. Louis, as well as in New York and Chicago.

Elyria, O.—The city desires catalogues and information on sewer cleaning machines. Martin Muller, director of public service; Thomas A. Conway, mayor; Rhose Morarity, clerk.

Union, S. C.—Special.—The Municipal Electric Light and Water Works has recently made extensive improvements at its plant. A 75-kw., 3-phase, 60-cycle, 2,300-volt generator, direct connected to a 135-h.p. Harrisburg engine, with necessary switchboards, has been added to the plant. R. A. Easterling is superintendent.

Nashville, Tenn.—Special.—One of the most up-to-date, modern stone-crushing plants has been erected by the Southern Bitulithic Company at Woodstock, Ala. This enterprise represents an investment of about $100,000. Machinery has been installed for the special purpose of crushing, separating and delivering to contractors any particular size stone they may need. We understand the company will also make a specialty of furnishrip-rap or rubble stone. Headquarters of the Southern Bitulithic Company are located at 602 First National Bank Building, Nashville, Tenn.

Spokane, Wash.—City engineer Macartney has recommended the purchase of a steam shovel, to cost about $4,000.

Lethbridge, Alberta, Can.—Bids will be received on November 24 for power house equipment, as follows: Section B, boilers and accessories; section C, mechanical draft and economizer; section D, steam turbo-generator set and condensing equipment; section E, steam-engine-driven exciter; section G, substation equipment. Certified check, 10 per cent. E. W. Robinson, secretary.

Patents on Road and Pavement Construction and Repair.

867,852. Device for Laying Concrete Pavements. Geo. W. and Geo. F. Switzer, Salisbury, N. C.

875,288. Manufacture of Bituminous Concrete. Jas. L. Rake, Reading, Pa., and Clifford Richardson, New York, N. Y.

881,669. Wheeled Scraper. Norman S. Dunaway, Pelham, Ala.

887,188. Process of Producing Road Metal (from slag). John F. Burn, Detroit, Mich.

890,328. Anticreeper for Rails. Adolphus Bonzano, Philadelphia, Pa.

894,346. Rolling Tamper. Geo. Ross and Stephen F. Deal, Kansas City, Mo.

900,626. Scraper. Wm. P. Warren, Sheridan, Ill.

900,729. Wood Block Paving. Wm. H. Harvey, Vancouver, B. C., Can.

905,190. Machine for Surfacing Roads, Pavements, Etc. Colin M. Ingersoll, New York, N. Y.

905,367. Road Grading Machine. John Rein, Whalan, Minn.

905,904. Road Grader and Scraper. Richard D. Moon and Geo. N. Chamberlain, San Angelo, Tex.

908,078. Road Scraper. John M. Dobey, Timewell, Ill.

909,228. Riding-Wheel Road Scraper. Sylvester Robinson and James A. Saffer, Emporia, Kan.

909,499. Road Construction. Fred'k. F. Williamson and Daniel Brennan, Jr., New York, N. Y.

909,966. Road Drag. Wm. A. Traver, Weedsport, N. Y.

910,025. Wheeled Scraper. Thos. H. Stagg and John Anthony, Columbus, O.

910,384. Road Grader. Lew Ireland, Fredericktown, Ohio.

910,568. Pavement and Method of Constructing the Same (of concrete in street car tracks). Jas. A. Omberg, Memphis, Tenn.

910,636. Machine for the Formation of Coverings on Streets, Roads and Other Places. John E. Behmer, Eskilstuna, Sweden.

910,705. Street Crossing. (Protected and reinforced concrete.) Simon B. Minnich, Landisville, Pa.

910,836. Ditcher and Road Grader. John D. Martin, Reynolds Sta., Ky.

910,922. Process of Removing Asphalt Pavement. Wm. E. Kerns, Fox Chase, Pa.

910,928. Adjustable Road Grader. John H. Koontz, Indian Creek tp., Monroe Co., Ind.

911,445. Composition Roadway. Benj. F. Richardson, Philadelphia, Pa.

912,126. Pavement. Walter E. Hassam, Worcester, Mass.

912,478. Surface Street or Road Railway for Automobiles and Other Vehicles. Madison Maquinn, Chicago, Ill.

912,898. Street Pavement or Roadway. August E. Schutte, Boston, Mass.

913,686. Method and Apparatus for Atomizing and Spraying Oily Materials. Heinrich O. Brandt, Manchester, Eng.

913,788. Snow Road Machine. John Warcup, Lemesurier, Quebec, Can.

914,241. Road Working Machine. Alonzo C. Callender, Port Gibson, Miss.

914,603. Paving Rammer. Niels C. Ovist and Wilhelm H. Nordstroem, Horsens, Denmark.

914,610. Wheeled Scraper. Allen H. and Luther L. Smith, Herman, Neb.

915,062. Road and Method of Building Same. Amzi L. Barber, Washington, D. C.

915,492. Road Machine. Marion M. Sickler, Buffalo, N. Y.

916,070. Pavement. Walter B. Warren, Newton, Mass.

916,179. Road Drag. Edward J. Mills, Webb, Iowa.

916,199. Road Grader or Scraper. Samuel Richardson, Hoover, Ind.

916,676. Apparatus for Cutting Road Beds. Lee D. Craig, San Francisco, Cal.

916,693. Pavement (concrete block). Wm. H. Fulcher, Oakland, Cal.

917,279. Road Grader and Scraper. Benj. A. Fleshman, Wyaconda, Mo.

917,528. Road Scraper. Jos. T. Bland, Pittsboro, N. C.

917,977. Road Grader. Sam'l. A. Ulrich, Mendota, Mo.

918,156. Road Construction and Art of Making Same. Frank S. Hutchinson, Flushing, N. Y.

918,490. Method of Forming Surfaces on Roads. Thos Aitken, Cupar-Fife, Scotland.

918,633. Grading Machine. Carl O. Wold, Minneapolis, Minn.

918,980. Wire Cut Brick. Frank B. Dunn, Conneaut, O.

918,993. Road Float. Franklin L. Gaines, Grand Rapids, Mich.

919,428. Flexible Road Drag. Ozro H. Gillespie, Madison, Neb.

919,530. Pavement. Rudolph S. Blome and Wm. J. Sinek, Chicago, Ill.

920,422. Road Drag. David C. Boyd, Galion, O.

920,807, 920,808. Paving Blocks. Edward Alcott, Pittsburg, Pa.

921,223. Road Crossing. Lott Frederick, Indiana, Pa.

922,493. Road-Grading Attachment for Vehicles. Winfield S. Livengood, Kansas City, Mo.

922,687, 922,688. Street Pavement. Samuel E. Finley, Atlanta, Ga.

923,195. Construction of Roadways, Footways and the Like. Geo. A., Arthur J. and Ernest E. Mitchell, London, Eng.

923,421. Asphalt Heater. Jas. F. Driscoll, and Harry Thompson, St. Louis, Mo.

923,891. Manufacture of Bituminous Roadways. Clifford Richardson, New York, N. Y.

924,086. Road Surface Preparation or Composition. Wm. A. and Sydney C. Meadows, Liverpool, Eng.

924,311. Road Drag. David C. Boyd, Galion, O.

924,810. Road Scraper. John A. Miller, Rosebud, Mo.

924,966. Road Grading Machine. Harry K. Clemons, St. Paul, Minn.

925,035. Wheeled Scraper. Chas. H. Sawyer, Minneapolis, Minn.

925,714. Road Roller. Josiah V. Miller, Judge, Mich.

926,062. Paving Block. Wm. Hanley, Bradford, Ind.

926,443. Apparatus for Laying Concrete Road Beds. Frank M. Talbot, Glenridge, N. J.

926,503. Road Grader and Ditching Machine. John M. Mock and Hollie C. Prather, Jewett, Ill.

927,239. Road Repairing Machine. W. G. Herring, Comanche, Tex.

927,315. Apparatus for Spreading Liquid Asphalt. Chas. A. Baldwin, Los Angeles, Cal.

927,887. Road Machine, Marion N. Sickler, Pala, Cal.

928,205. Road Grader. Winfield S. Livengood, Kansas City, Mo.

928,488. Pavement Cutter. Daniel E. Wiseman, San Francisco, Cal., and Fred F. Hedden, Chicago, Ill.

929,210. Street Paving Brick. Frank W. Grebe, Phillipsburg, Pa.

929,366. Pavement. Edward Alcott, New York, N. Y.
929,699. Rroad Scraper. James H. Osten, White City, Kan.
930,153. Paving Block. Samuel Butz, Easton, Pa.
930,161. Road Locking Block. Henry H. Dickson, Orlando, Fla.
931,085. Machinery for Heating and Rolling Bituminous Pavements. Chas. F. Prescott and Wm. E. Kerns, Philadelphia, Pa.
932,116. Road Oiler. Wm. H. Gailor, Saratoga Springs, N. Y.
932,941. Method of Making and Laying Paving Composition. Joseph H. Amies, Philadelphia, Pa.
933,521. Paving Block. David Atherton, Phillipsburg, Pa.
933,803. Apparatus for Making Tar Paving. James Ward, Grange,over-Sands, England.
934,030. Sheet-Wood Paving. Joseph H. Amies, Philadelphia, Pa.
934,071. Road Scraper. Edda G. Hartle, Columbus, O.
934,494, 934,495. Paving Compositions. Joseph H. Amies, Philadelphia, Pa.
934,630. Road Machine. Fred N. Root, Kalamazoo, Mich.
935,572, 935,573. Composition for Binding, Surfacing and Resurfacing Purposes in Street and Road Building, and Bituminous Cement. Jos. H. Amies, Philadelphia, Pa.
936,493. Pavement and Process for Making the Same. Jas. C. Travilla, St. Louis, Mo.
936,716. Road Oiler. Chas. M. Haeske, South Bend, Ind.
937,216. Road Scraper. Claude D. Kinsman, Lincoln, Neb.
937,660. Sprinkling Machine (for hot oil on roads). Ellis Tomer, Visalia, Cal.
937,822. Vitrified Paving Brick. Karl Langerbeck, Boston, Mass.
13,024 (reissue). Process for Preventing and Laying of Dust Through the Application to Roads or Road Material of an Aqueous Emulsion of Oil. Wm. M. Sandison, Ashfield, Ayton, Scotland.
938,249. Road Machine. Mathias Lampl, Iwissvale, Pa.
938,698. Method of Rejuvenating Asphalt. Jas. A. W. Pine, New York, N. Y.
938,003. Road Grader and Drag. Elmer B. Fritchman, Humansville, Mo.
939,664, 939,665. Road Scrapers. Cyrus H. Casner, Hepburnville, Pa.
939,877. Road Roller. Marquis J. Todd and David Farquhar, Buffalo, N. Y.
940,169. Road Making Machine. Elias L. Lathrop, Galion, O.
940,389. Road Grader. Arnold W. Hadley and Harvey M. Smith, Monroe tp., Morgan co., Ind.
940,432. Nosing for Curb Corners. Wm. S. Clifford, New York, N. Y.
940,666. Scraper. Harvey Bingaman and John A. Miller, Harding, S. D.
940,971. Method of Road Construction and Repair. Solon G. Howe, Detroit, Mich.
941,548. Road and Street Construction. Joseph H. Amies, Philadelphia, Pa.
941,886. Process of Laying Concrete Pavements. Franklin S. Lamson, Washington, D. C.
942,235. Method of Preparing Mineral Materials and the Like for Street and Road Construction. Jos. H. Amies, Philadelphia, Pa.
942,236, 942,237. Compositions for Paving Purposes. Jos. H. Amies, Philadelphia, Pa.
942,749. Road Grader and Scraper. Saml. Richardson, Hoover, Ind.
942,866. Road Working Machine. Michael A. Popkess, Kansas City, Mo.
13,055 (reissue). Apparatus for Cutting Roadbeds. Lee D. Craig, San Francisco, Cal.
943,667. Composition for Laying Road Dust and Hardening Road Beds. Carleton Ellis, Larchmont, N. Y.
943,864. Wheel Mounted Scraper. Lewis C. Fasig, Ashland, O.
944,652. Pavement. Wm. H. Baker, Sugar Creek, O.
945,088. Road Scraper. Stanley Griffin, Elyria, O.
945,179. Road Grader. Winfield S. Livengood, Kansas City, Mo.
945,312. Curbing (with internal conduit). Joseph Firth, Charlotte, N. C.
945,560. Machine for Making Roads. Alvin O. Lombard, Waterville, Me.
945,999. Road Construction. Joseph H. Amies, Philadelphia, Pa.
946,063. Road Grader. Frank A. Mattson, Cumberland, Wis.
946,187. Road Working Machine. Edward B. Winters, Coffeyville, Kan.
946,925. Road Drag. Walter S. Walker, Helena, Mo.
947,707. Road Scraper. Thos. and Albert A. Addison, Covington, Tenn.
948,720. Road Drag. Elbert L. Carroll and Robert M. Skiles, Creston, Iowa.
949,117. Road Machine. Jas. A. Ferguson, Cambridge, Mass.
949,588. Road Grader. Joseph P. Lutes, Buffalo, N. Y.
950,171. Road Scraper. John M. Harrington, Edgerton Jc., Mo.
950,457. Road Working Machine. John M. Parcel, Jr., Mendota, Mo.
950,541. Asphalt Expansion Joint. Cristopher S. McGinn, St. Louis, Mo.
952,338. Road Smoothing Device. Frederick W. Lechner, Wenona, Ill.
952,395. Road Grading Machine. Bennie Whittemore. Albert Lea, Minn.
952,882. Concrete Paving Machine. Reed Deeds, Cuyahoga Falls, O.
953,085. Road Grading Machine. Butler F. Elliott, Gotebo and Jacob L. Simmers, Ft. Cobb, Okla.
953,406. Road Grader. Wm. H. Beam, Purcell, Okla.
953,490. Street Gage. Patrick Roughen, Fond du Lac, Wis.
954,386. Road Grader. Adam Granser, Lodi, Wis.
954,692, 954,693, 954,694. Composition of Matter for Concrete, Building Brick and Road or Street Brick. Henry D. Phillips, Indianapolis, Ind.
954,966. Tread Surface for Pavements and the Like. Chas. B. Jacobs, Port Chester, N. Y.
13,101 (reissue). Road Grading Machine. Parley I. Jewett, Butler, Mo.
956,009. Method of Making Roads. Leonard S. von Westrum, Grand Rapids, Mich.
956,744. Road Grader. Henry Sunderman, Madison, Neb.
956,940. Oiled Concrete Roadway. Edward M. Chadbourne, San Francisco, Cal.
957,357. Road Grader. Thos. E. Lyon, Bucklin, Kan.
957,985. Process of Making Pavements. J. Y. McClintock, Rochester, N. Y.
958,063, 958,064. Street and Rural Constructions. Joseph H. Amies, Philadelphia, Pa.
958,346. Road Roller. Fredk. F. Williamson and Daniel Brennan, Jr., New York, N. Y.
958,891. Road Grader and Scraper. Frank L. Reising, Pipe City, Ill.
959,668. Road Scraper. Henry Wiechelman, Long Pine, Neb.
959,976. Composite Pavement. Edwin C. Wallace, East Auburn, Cal.
960,296. Road Grader and Ditcher. Jesse P. Evans and Julius B. West, Barton, Ark.
961,007. Road Drag and Grader. Orlando F. Phillips and Martin H. McCaulon, Butlerville, Ind.
962,150. Pavement. Harry G. Jennison, Toledo, O.
962,209. Road Oiler. Wm. H. Gailor, Saratoga Springs, N. Y.

(To be Continued.)

IMPROVEMENT AND CONTRACTING NEWS

RMP

ROADS AND PAVEMENTS.

BIDS REQUESTED.

Pensacola, Fla.—Nov. 14, 12 m. Paving construction as follows: 180,000 sq. yds. of clay or shale block, sheet asphalt, asphalt block, bitulithic, wood block or concrete pavement, and 116,000 lin. ft. of concrete curb. Certified check, $5,000. John A. Merritt, chairman board of bond trustees; George Rommel, Jr., engineer.

Monmouth, Ill.—Nov. 15. Constructing 9,300 sq. yds. and 5,400 sq. yds. of brick pavement on gravel base. R. M. Ferguson, city engineer.

Brazil, Ind.—Nov. 10, 11:30 a. m. Constructing one gravel road in Posey township. Edward A. Staggs, auditor.

Brownstown, Ind.—Nov. 6, 1:30 p. m. Constructing two roads. H. W. Wacker, auditor.

Decatur, Ind.—Nov. 6, 10 a. m. Constructing macadamized road in Jefferson township. H. F. Michaud, auditor.

English, Ind.—Nov. 6, 2 p. m. Constructing three miles of pike road. J. Evans Jones, auditor.

Fowler, Ind.—Nov. 6, 1 p. m. Constructing a stone road in York township. Lemuel Shipman, auditor.

Indianapolis, Ind.—Nov. 3, 2 p. m. Constructing gravel road on line between Franklin and Perry townships. Albert Sahm, auditor.

Jasper, Ind.—Nov. 6. Constructing rock road 2½ miles long in Columbia township. M. A. Sweeney, engineer.

Logansport, Ind.—Nov. 7, 10 a. m. Constructing one gravel road and one macadam road. J. E. Wallace, auditor.

Peru, Ind.—Nov. 9, 12 m. Constructing three roads. Fred J. McElheny, auditor.

Rensselaer, Ind.—Nov. 6, 2 p. m. Constructing five miles of stone road. James N. Leatherman, auditor.

Washington, Ind.—Nov. 7, 10 a. m. Constructing one gravel road. Thomas Nugent, auditor.

Winamac, Ind.—Nov. 7, 12 m. Constructing two highways. W. E. Munchenburg, auditor.

Cincinnati, O.—Nov. 3, 12 m. Constructing Forfeit Run road under specification number 258. Bond, $2,000. Fred Dreihs, clerk, board of Hamilton county commissioners.

Cleveland, O.—Nov. 15, 11 a. m. Improving Fairmount road. Certified check, $1,000. John F. Goldenbogen, clerk.

Cleveland Heights, O.—Nov. 7, 12 m. Improving Highland road with brick, asphalt or macadam, and constructing sidewalks. Certified check, 10 per cent. H. H. Canfield, clerk; The S. A. Pease Engineering Company, 931 Williamson building, Cleveland, O., engineers.

Pleasant Ridge, O.—Nov. 7, 12 m. Improving Kincaid road with macadam. Certified check, $250. H. B. Hayden, city clerk.

Newport, R. I.—Nov. 4, 11 a. m. Constructing vitrified brick paving at U. S. Naval Torpedo Station, Newport. R. C. Hollyday, chief of bureau of yards and docks, Washington, D. C.

CONTRACTS AWARDED.

Birmingham, Ala.—The following paving contracts have been awarded: Macadam on Thirteenth street, to the Southern Asphalt Co., $3,254; macadam on Ensley, to the same, $15,031; Third avenue, to Paul Richter, $1,408.

Los Angeles, Cal.—Improving 4.16 miles of road, to John W. Polcaro, $36,728.

Marysville, Cal.—Constructing bridge over Grasshopper slough, to F. E. Froh and Sons, $1,500.

Santa Monica, Cal.—Improving Seventh street, to Fred H. Stout, Bradbury building, Los Angeles, Cal., about $30,000.

San Francisco, Cal.—Constructing asphalt pavement, to the City Street Improvement Co., San Francisco, Cal.

Denver, Colo.—Paving West Twenty-third street with asphalt, to the Denver and Pueblo Construction Co., Denver, Colo., $21,771.

Hartford, Conn.—Constructing macadam road, to F. Arrigoni & Bro., Middletown, Conn.

Norwalk, Conn.—Constructing macadam roads, to Jno. A. McElroy.

Dover, Del.—Paving the Woodland Beach boulevard, to James R. Mott, $10,850.

Wilmington, Del.—Paving construction, to Harrigan Construction Co., Wilmington, Del., $29,750.

Freeport, Ill.—Constructing macadam on Jefferson street, to the Gund Graham Co., Freeport, Ill., $18,367.

Joliet, Ill.—Paving Jefferson street with asphalt, to R. F. Conway & Co., 133 West Washington street, Chicago, $12,695.

Park Ridge, Ill.—Constructing sewer and paving East Center street, to Cleary, White & Newman, $59,477.

Peoria, Ill.—Paving Liberty street with creosoted wood blocks, to J. W. Bushel, $11,084.

Newport, Ind.—The following road contracts have been awarded: The Deck road, to Kester Bros., $3,098; Hillsdale road, to Ingram & Co., $9,946; Range Line road, to Geo. W. Sykes, $7,845.

Coffeyville, Kan.—Paving West Third street, to McQuire and Stanton, $28,516.

Louisville, Ky.—Paving Broadway with asphalt, to the Barber Asphalt Co., $23,200.

Ashburnham, Mass.—Constructing state highway, to F. G. Magne, West Newton, $7,831.

Boston, Mass.—The following paving contracts have been awarded: Tar macadam in Fottler road, to William J. Rafferty, $3,776; tar macadam in Hiawatha road, to James Dougherty, $6,070; tar macadam in Dorris street, to Fred S. & A. D. Gore Co., $1,007; tar macadam in Bradfield Ave., to the West Roxbury Trap Rock Co., $9,048.

Boston, Mass.—Constructing macadam roadway, to the Rowe Contracting Co., Boston, Mass., $12,592.

Hardwick, Mass.—Constructing state roads, to Charles E. Horn, of Millbury, Mass., $11,000.

Minneapolis, Minn.—Constructing eight miles of Superior boulevard, to James O'Neill and Company, $33,675.

St. Joseph, Mo.—Paving Messinia street,

to the Young Bros. Construction Co., St. Joseph.

Jackson, Miss.—Paving West Capitol street, to the Southern Asphalt Paving Co., of Birmingham, Ala., $30,000.

Newark, N. J.—Paving Sixteenth avenue, to the Newark Paving Co., $10,736.

Rahway, N. J.—Paving Main street, to the Jersey Paving Corporation, of Newark, N. J., $24,000.

Toms River, N. J.—Constructing six miles of road, to John L. Le Compt, of Lakewood, N. J., $29,950; constructing five miles of road, to S. T. and L. W. Holman, of Whitesville, N. J., $18,976.

Schenectady, N. Y.—Constructing bitulithic paving, to the Warren Bros Co., of Boston, Mass., $42,397.

White Plains, N. Y.—Paving construction as follows: Orawaupum street, to E. L. Erbach; Walworth avenue, to Benjamin Ora; mo; Lake street, to the Connecticut Hassam Paving Co.

Yonkers, N. Y.—The following paving contracts have been awarded: Fairview avenue, to Charleton & Weston, 90 Asig street, $6,495; grading Frederick street, $15,-890, grading Marlborough avenue, $4,220, grading Palmetto street, $6,490, grading New avenue, $17,478, all to Charleton & Weston; grading Murray avenue, $44,500, to Thomas Grady, 11 Myrtle street; grading Armstrong avenue, to Fred E. Gross & Son, 819 Nepperham avenue, $2,300.

Yonkers, N. Y.—The following street improvement contracts have been let: Springer avenue, to Joseph L. Puozzo, 176 Oak street, $10,975; Alexander avenue, to Joseph L. Puozzo, $5,371; Glover avenue, to Kelly & Hanifin, 763 Palisade avenue, $5,-728.

Ashland, O.—Improving the Sullivan Southern road, to D. A. Phillips, Ashland, O., $5,820; improving the Sullivan Wellington road, to same, $8,600.

Bryan, O.—Macadamizing 1.52 miles of road in Pulaski township, to Fishbaugh, Karch and Appenzeller, Greenville, O., $11,-841.

Caldwell, O.—Paving North and Miller street with brick, to Wilson and Harper, of Barnesville, O., $11,000.

Caldwell, O.—Paving New street, to Wilson & Harber, of Barnesville, O., about $11,-000.

Cincinnati, O.—The following road contracts have been awarded: Tanner avenue, to John Nickoson, $10,205; improving of Burnt School House road, to O. E. Robinson, $5,234.

Cincinnati, O.—Improving Shawnee road, to Frank Hosbrook, of Blue Ash, O., $6,236.

Massillon, O.—Faving North Mill street, to A. F. Wendling, of Massillon, $10,186.

Medina, O.—The Kennedy Warner Co. has been awarded the contract for one mile of macadamized road, $9,000.

Palestine, O.—Paving 5,600 feet of the Elkton road, to Geo. B. Patterson, of Wellsville, O., $13,172.

Springfield, O.—Constructing road, to Walker & Scott, Cincinnati, O., $52,000.

Nowatta, Okla.—Constructing asphalt pavement, to the Southwestern Engineering and Construction Co., $52,935.

Tulsa, Okla.—The following paving contracts have been awarded: Sheet asphalt, to the Eureka Construction Company, Houston, Tex., $200,000; Trinidad sheet asphalt, to the Cleveland Trinidad Company, $26,000; brick alley, to the Parker Washington Construction Company, $4,000.

Medford, Ore.—Paving Third street, to Clark-Henery Co.

Pendleton, Ore.—Paving Webb and Alba streets, to the Warren Construction Co., Portland, Ore., $40,000.

Portland, Ore.—Paving Twenty-sixth street, to the Star Sand Co., Portland, $24,-480.

Cannonsburg, Pa.—Faving South Central avenue, to Maynard & Flynn, of Pittsburg, Pa.

Carbondale, Pa.—Faving Pike street, to John Booth, of Carbondale.

Dorrancetown, Pa.—Paving Butler street, to U. S. Wood Preserving Co., 165 Broadway, New York, $8,256.

Du Bois, Pa.—Paving North Main street, to Hatten & Co.

Erie, Pa.—Faving Ash street, to Mayer Bros. Construction Co.

Harrisburg, Pa.—Constructing 5,048 feet of road, to The Juniata Paving Co., of Philadelphia, Pa., $13,225.

Masontown, Pa.—Paving West Church street, to the Uniontown Construction Co., of Uniontown, Pa.

McKees Rocks, Pa.—Constructing bridge at Island avenue, to the Des Moines Bridge Co., of Des Moines, Ia., $19,800.

Mt. Pleasant, Pa.—Faving a number of streets with brick, to Maynard & Co., of Pittsburg, Pa., $14,020.

Pittsburg, Pa.—Grading, paving and curbing a number of streets, to James H. McQuaide Co., $13,715.

Pittsburg, Pa.—Paving 0.9 miles, to Thomas Cronin & Co., South Seventeenth street.

Pittsburg, Pa.—Widening Smithfield bridge, to John F. Pasey, $81,532.

Uniontown, Pa.—Constructing road, to Reed & Patton, of Curwensville, Pa., $67,000.

Huntington, Tenn.—Constructing concrete sidewalk, to the Monroe Construction Co., of Humboldt, Tenn.

Knoxville, Tenn.—Paving Baxter avenue, to the Barber Asphalt Paving Company.

Greenville, Tex.—Constructing five blocks of pavement, to the Texas Bitulithic Co., of Dallas, Tex.

Hamlin, Tex.—Constructing 20,000 sq. yds. of pavement, to Ray McDonald, of Marlin, Tex., $40,000.

Galveston, Tex.—Constructing brick roadway for arched bridge and mud-shell road, to J. P. Kelso, $24,300.

Colfax, Wash.—Constructing three miles of road, to the Wilson-Bailey, North Yakima, Wash., $23,270.

Seattle, Wash.—Paving First avenue, to Sloan Bros, 1013 East John street, $47,620; California avenue, to J. A. McEachern Co., $2,395; alley in Capital Hill addition, to Sanfield & Richie, 1233 Thirteenth avenue, North, $3,973.

Seattle, Wash.—The following street improvement contracts have been awarded: Prince avenue, to Sloane Bros., Forty-second avenue, South, $47,620; alley in block 37, to Sanfield and Richie, 1241 Eighteenth avenue, West, $3,973; Twenty-fifth avenue, West, to Hanson & Co., 4100 Twenty-fifth avenue, Southwest, $3,720; California avenue, to Hanson & Co., 4100 Twenty-fifth avenue, Southwest, $2,087; Twenty-second avenue, Northeast, to Andrew Peterson & Co., Montera, Wash, $28,401; Twenty-third avenue, West, to J. A. McEachern, Bailey building, Seattle, $5,993.

Spokane, Wash.—Grading Lacey street, to Naylor and Norlin, $2,889.

Vancouver, Wash.—Paving Twenty-sixth street with Tarvia, to the Star Sand Co., $24,800.

Morgantown, W. Va.—Paving Pine street, to Arthur M. Lucas & Co.

Wheeling, W. Va.—Paving Edgington Lane, to Springer and Stringer.

Ottawa, Ont.—Paving York street, to the Union Construction Co., of Ottawa, $23,739.

CONTEMPLATED WORK.

Montgomery, Ala.—The city is contemplating paving improvements to cost about $100,000

Ft. Smith, Ark.—The city is contemplat-

ing the repaving of Garrison avenue, to cost about $30,000.

Indianapolis, Ind.—Brightwood is contemplating paving of several streets with asphalt or brick.

Coeur d'Alene, Ida.—The city is contemplating street paving to cost $36,000.

Franklin, Ky.—A $70,000 bond issue for road improvements has been voted.

Detroit, Mich.—The committee on parks and boulevards has recommended the use of cheap asphalt on all boulevard construction.

Biwabik, Minn.—The city is contemplating the construction of curbs and gutters to cost $9,000.

Dundee, N. Y.—The village is contemplating the paving of Union and Seneca streets, to cost about $7,000.

Laurinberg, N. C.—A $30,000 bond issue for road construction has been voted. D. Z. Hardin, commissioner.

Columbus, O.—James R. Marker, state highway commissioner, has recommended an increased bond issue for road construction.

Pryor Creek, Okla.—The Benham Engineering Co., 812 American National Bank building, Oklahoma City, Okla., are preparing plans for eight blocks of pavement in the business district.

Hillsboro, Ore.—City is contemplating sewer construction to cost about $100,000.

Jacksonville, Ore.—A $1,500,000 bond issue has been voted for construction of roads in the county.

New Brighton, Pa.—The paving of Fifteenth street in Patterson Heights is contemplated.

Newcastle, Pa.—The city is contemplating the construction of a municipal light plant, sewage disposal plant and general street improvements.

Dallas, Tex.—The city is contemplating the paving of twelve miles of streets.

El Paso, Tex.—City is contemplating the construction of asphalt macadam pavement on fourteen blocks of Arizona street.

Louden, Tenn.—A $25,000 bond issue for road improvements has been voted.

Richmond, Va.—The city is contemplating the paving of a number of streets and the repaving of Broad street.

Kennewick, Wash.—Bids will be received about Nov. 15th for $54,000 worth of concrete sidewalks and curbs.

Omak, Wash.—A $4,000 bond issue for street improvements has been voted.

Pomeroy, Wash.—The county is contemplating the purchase of a motor road roller to cost $3,500.

SEWERS.

BIDS REQUESTED.

Texarkana, Ark.—Nov. 11, 1 p. m. Constructing 2.000 cu. yds. of levee, together with drainage ditches. Certified check, 25 per cent. Morgan Engineering Co., 610 Goodwyn Institute, Memphis, Tenn., engineers; N. H. Williamson, secretary.

Jellico, Tenn.—Nov. 8, 2 p. m. Constructing 5.7 miles of 8-in. to 15-in. pipe sewer. Letting postponed from Nov. 1 to Nov. 8. Walter G. Kirkpatrick, Jackson, Miss., engineer.

Kennewick, Wash.—Nov. 10, 11 a. m. Constructing main trunk sewer system. Certified check, $25. E. J. Wright, city clerk.

CONTRACTS AWARDED.

San Francisco, Cal.—Constructing 24-in. vitrified pipe sewer, to E. J. Gallagher.

Tracy, Cal.—Constructing sewerage system, to C. E. Vincent Contracting Company, Oakland, Cal., $56,300.

Park Ridge, Ill.—Constructing sewer and paving East Center street, to Cleary, White & Newman, $59,477.

Vincennes, Ind.—Sewer construction, for private corporation, to R. W. Laybe, Chicago, Ill.

Avoca, Ia.—Constructing sewer system, to C. H. Camoy, Harlan, Ia., $11,520.

Belle Plaine, Ia.—Constructing sanitary sewer system, to the Hoosier Construction Co., of Great Bend, Kan., $24,082.

Des Moines, Ia.—Sewer construction, to The Christie Construction Co., and to the J. W. Turner Improvement Co.

Keokuk, Ia.—Constructing sewer, to Cameron & McManus.

Marshalltown, Ia. — Paving Franklin street, to M. Ford, Cedar Rapids.

Primghar, Ia.—Constructing 3,036 ft. 8-in. sewer, to Garberick and Anderson, Sheldon, Iowa.

Columbus, Kan.—Constructing fifteen miles of sanitary sewers, to Koch & Koch, Joplin, Mo., $45,000.

Manhattan, Kan.—Constructing sanitary sewer, to the Kapz Construction Co., of Omaha, $9,240.

Birmingham, La.—The following sewer contracts have been awarded: Sanitary sewers in East Birmingham, to the Burkhalder Contracting Co., $7,505; sanitary sewers, to Ensley L. Brooks, $8,304.

Lake Charles, La.—Constructing 27 miles of 6 to 24-in. pipe sewers, to the Southern Asphalt & Construction Co., Birmingham, Ala.

Baltimore, Md.—Constructing high level intercepting sewer, to W. H. and E. F. Thompson Co., Baltimore, Md., $95,733.

Gilbertville, Mass.—Constructing sewerage system, to Lepards & Way, Springfield, Mass., $5,181.

Muskegon, Mich.—Constructing sewers, to E. W. Kruger, of Muskegon, $12,368.

Nashville, Mich.—Constructing sewer in district No. 2, to A. P. Southworth, of Adrian, Mich.

Hutchinson, Minn. — Constructing sewer extensions, to Fraser & Vanforth, of Rochester, Minn., $5,480.

Owatonna, Minn. — Constructing storm sewers, to J. P. Thon, $7,656.

Silver Lake, Minn.—Constructing sewerage system, to Fraser & Danforth, of Rochester, Minn., $5,479.

St. Paul, Minn.—Constructing sewers on St. Anthony avenue, to P. J. Ryan, $6,743.

Virginia, Minn. — Constructing sanitary sewers, to C. C. Butler, $9,270.

Kansas City, Mo.—Constructing south side sewer, to the R. J. & W. M. Boyde Co., $61,726.

Kansas City, Mo.—Constructing the Brush Creek intercepting sewer, to R. C. & E. Brown, $111,343.

St. Joseph, Mo.—Constructing sewer in district 54, to John Marshall.

Great Falls, Mont.—Constructing sewers, to F. E. Evans, $13,000.

Missoula, Mont.—Constructing storm sewers, to the James Kennedy Construction Co., Salt Lake City, Utah, $48,652.

Bradley Beach, N. J.—Extending sewerage system, to the Monmouth Contracting Company, Red Bank, N. J., $11,664.

Roselle, N. J.—Constructing sewer extension, to Louis Jacques, Elizabeth, N. J., $18,224.

Franklinsville, N. Y.—Constructing sewerage system, to J. B. Kuhn, Greensburg, Pa., $36,748.

Glens Falls, N. Y.—Constructing sewer system in South Glens Falls, to Sherman & Blackburn, $33,745.

Newburgh, N. Y.—Constructing sewer on Lake street, to Michael R. Stino, of Fishkill, N. Y., $10,440.

Perrysburg, N. Y.—Constructing a sewage disposal plant and sewerage system at the J. M. Adams Memorial Hospital, to Chas. A. Hager, of Buffalo, N. Y., $8,963.

Rochester, N. Y.—The following sewer

contracts have been awarded: Charles and Butler streets, to John J. Regan, $734; Clinton avenue, to H. N. Cowles, $2,945.

Yonkers, N. Y.—The following sewer contracts have been let: Constructing sewer in Bronx road, to Joseph L. Cuozzo, 176 Oak street, $16,643.

Yonkers, N. Y.—The following sewer contracts have been awarded: Belvedere Place, to Kelley and Hanifan, 763 Palisade avenue, $2,193; sewers in Glenn road and Glenn avenue, to the O'Rourke Contracting Co., 21 River View Place, $36,400.

Canton, O.—Constructing sewers, to F. A. Downs Construction Co.

Columbus, O.—Constructing Nilo trunk sewer, to H. E. Hunt, of Jackson, O.

Dayton, O.—Sewer construction, to Boyd & Cook, Dayton, O., $21,450.

Toledo, O.—Constructing main sewer No. 1119, to Albert Gryzbowski, $9,935.

Oklahoma City, Okla.—The following sewer contracts have been let: Sanitary sewers to Mayfield-Shaw Construction Co., $3,566; sanitary sewer, to the Stokes Construction Co., $3,560; sanitary sewers, to Derr & Broderick, $2,016.

Altoona, Pa.—Constructing reinforced concrete sewers, to Fogel & Co., Hollidaysburg, Pa.

Lebanon, Pa.—Constructing disposal plant, to M. Bennett & Sons, Indiana, Pa.

Reading, Pa.—Constructing Franklin street sewer, to Fehr & O' Rourke, of Reading, Pa., $40,413; completing Rose Valley sewer, to same, $36,839.

Rock Hill, S. C.—Constructing three disposal plants, to Porter & Boyd, Charlotte, N. C.,, $48,475.

Nashville, Tenn.—Constructing sewers on Shelby and Sylvan avenues, to Quinn & Ellis.

Corpus Christi, Tex.—Constructing section of sewerage system, to Truehart & Jackson, of San Antonio, $31,000.

Dallas, Tex.—Constructing storm sewer on Pennsylvania avenue, to J. W. Smith & Son, $34,912.

Centralia, Wash.—Constructing sewers, to the Lister Construction Co.

Seattle, Wash.—Sewer construction as follows: Greenwood avenue, to Becker & Walker, 364 Johns street, $5,553; Interlake avenue, to Ferguson-Coit Co., Arcade Annex, $47,814.

Spokane, Wash.—The following sewer contracts have been awarded: Sixteenth avenue, to John Getman, East 17 102 Fifteenth avenue, $1,820; Sixteenth avenue, to J. L. Wood, East 1609 Sprague avenue, $4,030.

Spokane, Wash.—Sewer construction as follows: Construction in first ward district, to P. L. Langan, East 2327 Boone avenue, at $14,176; construction sewer in Twenty-fifth and Twenty-sixth avenues, to R. B. De Camp, East 805 Eighth avenue, at $5,721.

Vancouver, Wash.—Constructing trunk eswer, to the Johnson-Anderson Co., of Portland, $35,315.

Parkersburg, W. Va.—Constructing sewer on Laird avenue, to the Cantrel Construction Co.

Wheeling, W. Va.—Constructing sewer system on Sycamore street, to J. L. Fligar & Sons Co., of Patterson, Va.

Patterson, W. Va.—Constructing sewer on Sycamore street, to J. L. Fligar & Son.

Racine, Wis.—Constructing sewer in the Case Addition, to Andrew Thompson, $9,563.

CONTEMPLATED WORK.

Union Springs, Ala.—The city is contemplating the construction of a sewerage system. Wilburn Hill is engineer.

Little Rock, Ark.—The city is contemplating the construction of a storm sewer in the east end. H. Levinson, superintendent of public works.

Osceola, Ark.—The city is contemplating a sewer system to cost about $20,000. F. L. Gladish, sewer commissioner.

Nogalez, Ariz.—A $175,000 bond issue, for installation of water works and sewer system, has been voted.

Imperial, Cal.—The city is contemplating the construction of a sewerage system to cost about $27,000. Irvin Maupin, city clerk.

Los Angeles, Cal.—The city is contemplating the extension of the Wilshire boulevard storm sewer.

Denver, Colo.—Sewer extensions, to cost about $2,500,000, are contemplated.

Pueblo, Colo.—William Peach is preparing plans for sewerage extensions to cost about $35,000.

Zebulon, Ga.—The J. B. McCrary Co., Empire building, Atlanta, Ga., has been retained to prepare plans for a water works system.

Mt. Pleasant, Ia.—Plans are being prepared for a sewerage system to cost about $30,000.

Baltimore, Md.—It is stated that the sewerage commission will require $4,000,000 for sewerage work during 1912.

Kansas City, Mo.—Constructing sewer on south side, to R. J. & W. M. Boyd Construction Co., $16,726.

St. Joseph, Mo.—The improvement of the lower Whitehead sewer, to cost about $40,000, is contemplated.

Las Vegas, Nev.—The city is contemplating the construction of a sewer system to cost about $40,000.

Plainfield, N. J.—The city is contemplating the enlargement of the disposal plant.

Berea, O.—The construction of a sewer on Pearl street is contemplated.

Corona, N. Y.—The city is contemplating construction of sewers to cost about $200,000.

Glencove, N. Y.—A $150,000 bond issue for the installation of a sewerage system has been voted.

Mamaroneck, N. Y.—The city is contemplating the construction of a sewerage system and disposal works to cost about $122,000.

Oswego, N. Y.—The city is contemplating the construction of a sewerage system and disposal plant to cost $183,000. T. Chalkley, Hatton, consulting engineer, Wilmington, Del.

Sea Cliff, N. Y.—The village is contemplating a sewerage system to cost about $120,000. Clyde Potts, 30 Church street, New York, engineer.

Akron, O.—A $60,000 bond issue for sewer construction has been voted.

Springfield, O.—The city is contemplating sewer construction to cost about $1,000.

Xenia, O.—The city is contemplating the construction of a sewage disposal plant to cost about $40,000.

Pryor Creek, Okla.—A $10,000 bond issue for sewer extension has been voted. The Benham Engineering Co., 812 American National Bank building, Oklahoma City, Okla., are preparing plans. Bids will be received about Nov. 15.

Altoona, Pa.—Hering & Fuller, consulting engineers, New York City, are preparing plans for a sewer system and filtration plant fof the city.

Garrick, Pa.—The borough is contemplating a sanitary sewerage system to cost about $70,000.

Duquesne, Pa.—Leo Hudson, of McKeesport, has been retained to prepare plans for a sewerage system.

Erie, Pa.—City Engineer B. E. Briggs has prepared plans and specifications for connection to the Mill Creek intercepting sewer.

Newcastle, Pa.—The city is contemplating the construction of a municipal light plant, sewage disposal plant and general street improvements.

North Wales, Pa.—The city is contemplating a sewerage system to cost $53,000.

Patterson Heights, Pa.—Carl S. Donaldson of Beaver Falls, Pa., has been retained to prepare plans for a sewerage system for the borough.

Pittsburg, Pa.—Upon Mayor William A. Magee's request the city council has authorized an appropriation of $5,000 for retaining consulting engineers on the proposed sewerage works.

Susquehanna, Pa.—The borough has been instructed by the state department of health to extend its sewerage system and construct a disposal plant.

Sioux Falls, S. D.— A$200,000 bond issue for sewer extensions has been voted.

Columbia, Tenn.—The city is contemplating the construction of sewers on South Garden and North High streets.

St. Elmo, Tenn.—An $80,000 bond issue for sewer construction has been voted.

Lampasas, Tex.—The city is contemplating the construction of a sewage disposal plant and a municipal garbage crematory. Mayor W. H. McGuire.

Coburg, Wash.—The city is contemplating the installation of a sewerage system.

North Yakima, Wash.—The city is contemplating the construction of a sewer system to cost about $50,000.

Tacoma, Wash.—The city is contemplating the construction of sanitary sewers in the alley between McKinley and Spokane avenues and on East I street.

WATER WORKS.

BIDS REQUESTED.

Loreaville, La.—Nov. 15. Constructing water works system, including wooden tank and tower. City clerk.

Jellico, Tenn.—Nov. 8, 2 p. m. The date for receiving proposals on the following water works material has been postponed from Nov. 1 to Nov. 8: 1,160 tons of cast iron pipe, 70 hydrants, 80 valves 500,000-gal. reinforced concrete reservoir, laying 12½ miles of 3-in. to 10-in. water mains. Walter G. Kirkpatrick, Jackson, Miss., engineer.

CONTRACTS AWARDED.

Tracy, Cal.—Constructing water works system, to the Western Engineering and Supply Co., Oakland, Cal., $21,200.

Harrington, Ill. — Constructing water works extensions and laying mains, to H. D. A. Drebe, of Barrington, $5,922.

Laporte, Ind.—Constructing water works system, to A. M. Osborn, Chicago.

Belle Plaine, Ia.—Constructing water works extension, to Malory and Company, Kewanee, Ill., $17,173.

Inwood, Ia.—Constructing water works system, to W. D. Lovell, 1415 Eighth street, Minneapolis, Minn., $12,644.

Syracuse, Kan.—Constructing complete water works and electric light systems, to the Tunkawa Construction Co., of Tunkawa, Okla., $35,010.

Boston, Mass. — The following water works contracts have been awarded: Setting concrete meter boxes, to Chas. J. Jacobs Co., $3,345; laying main in Frankfort avenue, to Hugh McNulty, $1,553; laying main in Orchard avenue, to Raffale Cartullo, $1,356.

Worthington, Mass.—Water works construction, to Crosby & Parker, Brattleboro, Vt.

Clarksville, Miss.—Water works construction has been awarded as follows: Air compressor and pump, to Allen Engineering Co., Memphis; pipe, to the U. S. Cast Iron Pipe & Foundry Co., Birmingham; valves and hydrants, to the Columbian Iron Works, Chattanooga.

Pacific, Mo.—A $15,000 bond issue for construction of a water works system has been voted.

Argyle, N. Y.—Construction of water works in Washington county almshouse, to John B. Dower, $90,030.

Matteawan, N. Y.—Laying 22,000 feet of pipe, to Partridge & Burke, of Irvington, N. Y.

Tarrytown, N. Y.—Constructing water mains, to Edward Jackman; furnishing pipe, to the Standard Pipe & Foundry Co.

Rutherfordton, N. C.—Constructing water works and electric light plant, to B. F. Rucker, Charlotte, N. C.

Dunseith, N. D. — Constructing water works system, to the Northern Construction & Engineering Co., Grand Forks, N. D., $6.000.

Toledo, O.—Constructing filter for water works system, to the Beers-Offutt Contracting Company, of Fort Wayne, Ind., $114,400.

Bokchito, Okla. — Constructing water works plant, to George Erickson, of Durant, Okla.

Muldrow, Okla.—Constructing combined electric light and water plant, to F. R. Stone, of Lima, O., $26,700.

Muskogee, Okla.—Constructing 6,000,000-gal. water purification plant, to W. W. Fuller, Muskogee, $45,027.

Medford, Ore.—Constructing water mains in South Holly street, to Jacobsen-Bade Co.

Jacksonville, Ore.—Constructing water works, to C. E. Bade, $35,000.

Tarentum, Pa.—Drilling test wells for the municipal water works plant, to R. H. Black, of Braddock, Pa.

Wehrum, Pa.—Paul Azzara, of Bartlesboro, Pa., has received the contract for constructing 20,000-gal. reservoir for the Lackawanna Coal & Coke Co.

Dallas, Tex.—Equipping three wells with pumping machinery, to the Harris Air Pump Co., Indianapolis, Ind.

Fond du Lac, Wis.—Constructing a new well on the grounds of the county asylum, to W. H. Carter Contracting Co., 2720 West Monroe street, Chicago, Ill.

New Lisbon, Wis.—Constructing water works and an electric light plant, to the Central Construction Co,, of Oshkosh, Wis.

Hull, Que., Canada.—Constructing water works extension, to Risson & Carriere, of Hull.

CONTEMPLATED WORK.

Nogalez, Ariz.—A $175,000 bond issue for installation of water works and sewer system has been voted.

Clayton, Del.—The installation of a water works system is contemplated.

Baxley, Ga.—The city is contemplating the construction of a water works plant.

Dalton, Ga.—The city is contemplating the installation of a filtration plant.

Atkinson, Ill.—The city is contemplating water works construction to cost $50,000. Jesse Steiner, city clerk.

Normal, Ill.—A $15,000 bond issue for the construction of a water works system has been voted.

St. Charles, Ill.—Water works extensions are contemplated and the following material will be required: 155 tons of -in. cast iron pipe, 22 tons of 4-inch cast iron pipe, 7,445 pounds special castings, 21 pipe hydrants, four 4-in. gate valves, five 6-in. gate valves. Bids will be asked about Nov. 1, 1911. E. N. Lamb, city engineer.

Ferdinand, Ind.—The town is planning to construct a water works system.

Mount Vernon, Ia.—Construction of a reinforced concrete storage reservoir is contemplated. W. W. Schirer, clerk; Iowa Engineering Co., Clinton, Ia., engineers.

New London, Ia.—The village is contemplating the construction of a water works system.

Redfield, Ia.—A $15,000 bond issue, for electric light and water works, has been voted.

Corbin, Ky.—The city is contemplating the construction of a water works system.

Hill City, Kan.—A $50,000 bond issue, for water works and electric light improvements, has been voted.

Valley Falls, Kan.—A $35,000 bond issue for the installation of a water works system has been voted. Burns and McDonnell, Kansas City, Mo., engineers.

Le Compte, La.—A $28,000 bond issue for water works system has been voted.

Roseland, La.—A $21,000 bond issue for a water works system has been voted.

Lansing, Mich.—The city is contemplating additions to the water works system.

Duluth, Minn.—The Crosby Water, Light & Power Co. has been incorporated with a capital stock of $50,000 by Francis H. De Groat, William P. Harrison and Grace Weiss.

Boonville, Mo.—A $10,000 bond issue for water works construction has been voted.

Unionville, Mo.—A $10,000 bond issue for water works construction and the reconstruction of an electric light plant has been voted. B. H. Bonvoey, mayor.

Amory, Miss.—A $25,000 bond issue for water works and sewerage system has been voted. The Solomon-Nortroff Co., Candler building, Atlanta, Ga., engineers.

Bethany, Neb.—The village is planning to receive bids on a water works plant, for which a $20,000 bond issue was recently voted.

Plattsmouth, Neb.—The City is contemplating the installation of a municipal water plant.

Newark, N. J.—The Gillette Water Co. has been incorporated with a capital stock of $25,000 by J. B. R. Smith, E. O. Clark and J. B. Reilly.

Plainfield, N. J.—James H. Fuertes, consulting engineer, 140 Nassau street, has been retained to prepare plans for a municipal water works system.

Fishkill Landing, N. Y.—The village has issued a $4,000 bond issue for water works extension.

Newburgh, N. Y.—A new system of mains to cost $4,000 will be installed on Colden and Water streets.

Albemarle, N. C.—Gilbert C. White, of Charlotte, N. C., is preparing plans for a $40,000 water works and electric light plant.

Selma, N. C.—The city is contemplating extension to the water works and electric light plant to cost about $20,000.

Akron, O.—A resolution has been adopted providing for the purchase of a water plant. R. A. Meyer, president of council.

Cambridge, O.—The village is contemplating the construction of a water works system to cost about $15,000. B. L. Rankin, president of council.

Cincinnati, O.—Superintendent Richards has recommended the construction of a filtration plant and a new settling basin.

East Liverpool, O.—The city is contemplating the construction of a water works plant to cost about $150,000.

Hubbard, O.—The village is contemplating a water works system to cost $30,000.

Ironton, O.—The town is contemplating the construction of a water works system.

Malvern, O.—The village is contemplating the construction of a municipal water works plant.

Navarre, O.—The city is contemplating the construction of a $25,000 water works system. L. E. Chapin, Canton, O., engineer.

Perryville, O.—A franchise has been granted to Frederick A. Witzler, to operate a power plant and water works system. H. R. Roether, mayor.

Boley, Okla.—The city is contemplating the construction of a water works system to cost $33,000.

Bristow, Okla.—A $5,000 bond issue for water works extensions has been voted.

Grove, Okla.—The city is contemplating the construction of a water works and electric light plant. Western Engineering Co., Oklahoma City, Okla., engineers.

Mandum, Okla.—The Benham Engineering Co., 812 the Northern National Bank building, Oklahoma City, Okla., will install two 8-in. syphon lines in connection with the water works system. About 2,000 lin. ft. of 8-in. cast iron water main will be required.

Ochelata, Okla.—The Western Engineering Co., Oklahoma City, Okla., are preparing plans for a water works system and electric light plant to cost $15,000.

Pryor Creek, Okla.—A $70,000 bond issue for a water works extension has been voted, and the Benham Engineering Co., 812 American National Bank building, Oklahoma City, Okla., are preparing plans. Bids will be accepted about Nov. 15.

Talihina, Okla.—A $25,000 bond issue for the construction of a water works system has been voted.

Westville, Okla.—The village has voted to construct a water works system. G. L. McKebbon, Muskogee, Okla., engineer.

Albany, Ore.—The city is contemplating the installation of a municipal water works plant.

Falls City, Ore.—A $5,000 bond issue for the extension of the water works system has been voted.

Gresham, Ore.—A $20,000 bond issue for water works extension has been voted.

Marshfield, Ore.—The construction of a municipal water works system is contemplated.

Portland, Ore.—The city is contemplating the extension of the water works system. D. E. Clarke, engineer.

Woodburn, Ore.—A $25,000 bond issue for water works improvements has been voted.

Bloomburg, Pa.—The city is contemplating the construction of a filtration plant.

Greencastle, Pa.—The city is contemplating the construction of a 12,000,000-gal. reservoir.

Lock Haven, Pa.—William Rathgeber, superintendent of the West End Water Co., has announced the proposed extension of the water works system to Dunnstown and Salona.

Martinsburg, Pa.—J. L. Henry, of Hollidaysburg, Pa., has been retained to prepare plans for a $20,000 water works system.

Tarentum, Pa.—Engineer Kennedy has prepared plans for a municipal water plant.

Tarentum, Pa.—Borough Engineer Kennedy has prepared an estimate for the construction of a 2,000,000-gal. reservoir and a system of drilled wells to cost $100,000.

Warren, Pa.—The city is contemplating the purchase of a water works system at a cost of about $490,000.

Kings Tree, S. C.—J. Newton Johnston, of Florence, S. C., has been retained to prepare plans for a $40,000 water works system.

Sioux Falls, S. D.—A $100,000 bond issue for the extension of the municipal water works system has been voted.

Baird, Tex.—The city is contemplating the construction of a water works system.

Honeyville, Utah.—A $12,000 bond issue for water works construction has been voted.

Preston, Utah.—The city is contemplating extensions to the water distribution system to cost $25,000.

Elma, Wash.—A $10,000 bond issue for

water works extensions have been voted.

Granger, Wash.—The construction of a water works system to cost $20,000 is contemplated. M. W. Avery, engineer.

Grafton, W. Va.—A $90,000 bond issue for construction of a water works system has been voted.

Wheeling, W. Va.—The board of control has been instructed to request bids for the construction of a filtration system.

BRIDGES.

BIDS REQUESTED.

Jasper, Ind.—Nov. 14, 1 p. m. Constructing bridge over White river at Portersville. Michael Sweeney, auditor.

Jersey City, N. J.—Nov. 2, 11 a. m. Constructing bridge over Passaic river. Certified check, $50,000. Patrick J. Condon, chairman joint committee of Hudson and Essex townships.

Fargo, N. D.—Nov. 2, 12 m. Constructing wooden bridge. Certified check, $50. Addison Leach, county auditor.

Zanesville, O.—Nov. 13. Repairing superstructure of Third street swing bridge. Certified check, 10 per cent. H. A. Duerhaus, county auditor.

Portland, Ore.—Nov. 3, 12 m. Constructing superstructure of a bridge over the Williamette river at Broadway. Ralph Modjeski, Monadnock building, Chicago, Ill., engineer; A. L. Barbour, Portland, auditor.

CONTRACTS AWARDED.

Ione, Cal.—Constructing steel bridge, to the Clinton Bridge & Iron Works, $10,530.

Oroville, Cal.—Constructing bridge, to the Ross Construction Co., $47,500.

Pasadena, Cal.—Constructing reinforced concrete viaduct, to Mesmer & Rice, $13,662.

San Bernardino, Cal.—Constructing two bridges, to the Security Construction Co., $4,150 and $11,797.

Jacksonville, Fla.—Constructing Hillsboro river bridge, to the Owego Bridge Co., Owego, N. Y., $205,000.

Boise, Ida.—Constructing three steel bridges, to the Missouri Valley Bridge and Iron Company, of Denver, Colo., $5,944.

Burley, Ida.—Constructing steel highway bridge across the Snake river, to the Portland Bridge and Iron Co., Portland, Ore., $17,289.

Pocatello, Ida.—Constructing bridge at McGregor's Ford, to Chas. D. Sheely, of Denver, Colo., $6,225.

Weiser, Ida.—Constructing 140-ft. span steel bridge, to the Coast Bridge Co., of Portland, Ore.

Chicago, Ill.—Constructing a bridge over the north branch of the Chicago river, to the National Contracting Co., Security building, Chicago, $29,000.

La Salle, Ill.—Constructing eight bridges, to the Joliet Bridge and Iron Co., of Joliet, Ill.

Shermerville, Ill.—Constructing bridges, to the Crowley Crosbury Construction Co., Davenport, Ia., $30,000.

Fowler, Ind.—Bridge contracts have been awarded as follows: Seven bridges, to Parker & Cheek, $2,043; nine bridges, to C. A. Miccum, $2,805; four bridges, to E. C. Weddle, $984; three bridges, to T. H. Warren, $705; four bridges, to C. A. Bolds, $1,172.

Franklin, Ind.—The following bridge contracts have been awarded: To L. A. Farr, Edinburg, Ind., $1,337; W. L. Wright, Nineveh, Ind., $5,580; to Albert Harman, Columbus, Ind., $1,775; to Harry E. Hill, Needham, Ind., $1,061; to Frank B. Hughes, Franklin, Ind., $1,376; to Haskell Ferguson, Franklin, Ind., $200.

Kansas City, Kan.—Constructing bridge at St. James street, to the Mt. Vernon Bridge Co., Mt. Vernon, O., $142,8[illegible].

Natchitoches, La.—Constructing bridge over the Cane river, to Austin Bros., of Dallas, Tex., $7,600.

Springfield, Mass.—The Lucius Engineering Co. has been awarded the contract for constructing a bridge over Main street.

Kansas City, Mo.—Constructing temporary pile bridge over the Kaw river, to the Mount Vernon Bridge Co., $13,889.

Canajoharie, N. Y.—Constructing bridge over the Mohawk river, to Lathrope Shea and Henwood Co., Buffalo, N. Y., $43,440.

Phoenix, N. Y.—Constructing concrete bridge, to Walter Bradley & Co., Fulton, N. Y., $18,000.

Lima, O.—The following bridge contracts have been let: Metzzer bridge, to Joe Mueller; constructing a concrete bridge, to Lyons and Seimer, of Lima, O.

Portland, Ore.—Constructing viaduct over tracks of the Southern Pacific, to the Pacific Bridge Co., Portland, Ore., $70,000.

Canajoharie, N. Y.—Constructing a bridge over the Mohawk river, to Lathrop, Shea and Henwood, of Buffalo, N. Y., $44,440.

Carlisle, Pa.—Bridge contracts have been awarded as follows: One reinforced concrete arched bridge, to the Martin Stone Co., of West Fairview, Pa.; constructing concrete bridge, to the Buchanan-Meredith Co., of Chambersburg, Pa.

Johnstown, Pa.—Constructing concrete and steel bridge, to J. A. Lord, Hastings, Pa., $9,000.

Pittsburg, Pa.—The commissioners of Stowe township have awarded contracts for structural work on Island avenue bridge to the Des Moines Bridge Company, Des Moines, Ia., $19,800.

Sussex, Va.—Constructing five bridges, to the Roanoke Bridge and Iron Co., Roanoke, Va., $5,350.

Everett, Wash.—Constructing steel bridge over the Sultan river, to the International Contract Company, 501 Central building, Seattle, $10,870.

Huntington, W. Va.—Constructing bridge over the Guyan river, to the Virginia Bridge and Iron Co. of Roanoke, Va., $12,500.

CONTEMPLATED WORK.

Globe, Ariz.—The county is contemplating the construction of a $12,000 bridge over the Black river. Frank L. Gates, clerk board of supervisors.

Pine Bluff, Ark.—Hendrick & Cochrand, of Kansas City, Mo., are preparing plans for a bridge across the Arkansas river.

Pasadena, Cal.—A $200,000 bond issue for a bridge across the Arroyo Seco has been voted. Waddell & Harrington, Kansas City, Mo., engineers.

Norwalk, Conn.—The city is contemplating the construction of a bridge across the Norwalk river.

Bliss, Ida.—A bridge to cost $10,500 will be constructed by the counties of Lincoln and Twin Falls.

Waukegan, Ill.—The city is contemplating the construction of a 400-ft. concrete viaduct at Genesee street. Westcott & Ronneberg, 189 West Madison street, Chicago, engineers.

Muscatine, Ia.—The city is planning to construct a steel and concrete bridge over Sugar street.

Norton, Kan.—The county commissioners are contemplating the construction of eleven bridges to cost from $200 to $500 a piece.

Lake Charles, La.—The city is contemplating the construction of a bridge to cost about $50,000 across the Calcasieu river. T. H. Mandell, city engineer.

Holyoke, Mass.—A new bridge will be constructed over the Connecticut river at High street. W. J. Howes, architect.

Lowell, Mass.—The city is contemplating the construction of a 6,000,000-gal. reservoir and the installation of a new pumping station. Frank A. Barbour, Tremont building, Boston, Mass., engineer.

Cleveland, O.—A $900,000 bond issue for the construction of a bridge to connect East and West Park avenue has been voted.

Corvallis, Ore.—The county is contemplating the construction of a $60,000 bridge across the Willamette river.

Portland, Ore.—Ralph Modjeski, of Chicago, has completed plans for the $800,000 Broadway bridge.

Charleroi, Pa.—The city is contemplating the construction of a 500-ft. concrete viaduct.

Jeannette, Pa.—The city is contemplating the construction of a steel bridge at Second street.

Reading, Pa.—A $475,000 bond issue for constructing the Penn street bridge has been voted.

Athens, Tenn.—A $35,000 bond issue for bridge construction has been voted.

Selmer, Tenn.—The McNairy county court has made appropriations for two steel bridges.

Ft. Worth, Tex.—The city is contemplating the construction of a $2,000,000 bridge over the Trinity river.

Olympia, Wash.—The city engineer has been instructed to prepare plans for a bridge at Garfield avenue.

Seattle, Wash.—The construction of a $40,000 bridge at Ravenna park is contemplated.

STREET LIGHTING.

BIDS REQUESTED.

Champaign, Ill.—Nov. 4. Lighting streets with gas or electricity for a term of years. William Coughlin, mayor; Carl Hayes, city engineer.

Fremont, O.—Nov. 21. Bids will be received for lighting the streets and alleys for a period of ten years. Director of public service.

CONTEMPLATED WORK.

Elcajon, Cal.—Merchants on Main street are contemplating the installation of ornamental street light. The San Diego Consolidated Gas and Electric Company is the local public utility.

Americus, Ga.—A company, headed by Frank Lanier and Frank Sheffield, has been organized to construct a light, heat and power plant.

Baxley, Ga.—The construction of an electric light plant is contemplated.

Galena, Ill.—The town is contemplating the installation of boulevard lights on Main street.

Pana, Ill.—The city is contemplating a street lighting system.

Peoria, Ill.—The city is contemplating the erection of ornamental light poles on Jefferson street.

Huntington, Ind.—The city is contemplating the installation of an ornamental lighting system.

Montezuma, Ind.—The town has voted to install a municipal electric light plant.

Cedar Rapids, Ia.—The city is contemplating the installation of an ornamental lighting system.

Farley, Ia.—A bond issue for the construction of a municipal gas plant has been ordered.

Galva, Ia.—The city is planning the installation of an electric light plant.

Redfield, Ia.—A $15,000 bond issue for electric lights and water works has been voted.

Hill City, Kan.—A $50,000 bond issue for water works and electric light improvements has been voted.

Waterville, Kan.—The installation of a municipal electric light plant is contemplated.

Bay City, Mich.—Merchants on Water street are contemplating the installation of an ornamental light system.

Detroit, Mich.—The Grand River Improvement Association is agitating the question of ornamental lighting system. C. A. Coppock, president.

Unionville, Mo.—A $10,000 bond issue for water works construction and the reconstruction of an electric light plant has been voted. B. H. Bonvoey, mayor.

Lestershire, N. Y.—The board of trustees are contemplating the installation of ornamental light on Main street.

Poughkeepsie, N. Y.—The city is contemplating the extension of the ornamental street lighting system.

Selma, N. C.—The city is contemplating extensions to the water works and electric light plant to cost about $20,000.

Delaware, O.—The city is contemplating the purchase of the plant of the electric light and power company.

Perryville, O.—A franchise has been granted to Frederick A. Witzler to operate a power plant and water works system. H. R. Roether, mayor.

Sharon, O.—The city is contemplating the construction of a municipal light plant to cost about $50,000.

Springfield, O.—The city is contemplating the construction of a municipal light plant.

Grove, Okla.—The city is contemplating the construction of water works and electric light plant. Western Engineering Co., Oklahoma City, engineers.

Ochelata, Okla.—The Western Engineering Co., Oklahoma City, Okla., are preparing plans for a water works system and electric light plant to cost $15,000.

Dufur, Ore.—The construction of a municipal electric light plant is contemplated.

Eugene, Ore.—The village is contemplating the installation of a Tungsten electric light system to cost about $25,000.

Portland, Ore.—The installation of an ornamental municipal lighting system on Grand avenue is contemplated.

Carlisle, Pa.—The Carlisle Light, Heat & Power Co. has been incorporated for $5,000.

Midland, Pa.—The People's Electric Light and Power Co. has been incorporated with the following officers: E. H. Casey, president; J. I. Mcill, secretary; H. L. Guthers, treasurer.

Newcastle, Pa.—The city is contemplating the construction of a municipal light plant, sewage disposal plant and general street improvements.

Reading, Pa.—The City Light, Heat and Power Co. has been incorporated by Charles H. Bowman.

Sharon, Pa.—The city is contemplating the construction of a municipal electric plant.

Aberdeen, S. D.—City is contemplating the installation of a municipal light plant.

Ellensburg, Wash.—The city is contemplating the installation of an ornamental lighting system.

Spokane, Wash.—City Engineer McCartney has planned for special ornamental lamp posts to be erected on the Monroe street bridge.

Walla Walla, Wash.—The city is contemplating the construction of a municipal light plant.

Follansbee, W. Va.—The Steubenville and Liverpool Railway and Light Co. is con-

templating the installation of a street lighting system in Follansbee.

Prince Albert, Man., Canada.—P. B. Smith, consulting engineer, Winnipeg, Man., has prepared plans for the construction of a municipal light plant, to cost $250,000.

Niagara Falls, Ont., Canada.—The lighting of the boulevard between Niagara Falls and Port Erie with cluster ornamental lights is contemplated.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

CONTEMPLATED WORK.

Berkeley, Cal.—The city is contemplating the erection of a garbage incinerator.

Newman, Cal.—The city is contemplating the construction of a garbage incinerator.

Columbus, Ga.—The construction of a garbage crematory, to cost $80,000, has been recommended by the health department.

Oklahoma City, Okla.—The city clerk has been instructed to advertise for bids for seven city lots, on which to build an incinerating plant, for which $25,000 is available.

Newcastle, Pa.—The city is contemplating the rebuilding of the garbage disposal plant, at the cost of about $2,000.

Lampasas, Tex.—The city is contemplating the construction of a sewage disposal plant and a municipal garbage crematory. Mayor W. H. McGuire.

FIRE APPARATUS.

BIDS REQUESTED.

Jacksonville, Fla.—Nov. 6. Furnishing 2,000 ft. of 2½-in. rubber-lined fire hose. T. W. Haunsy, fire chief.

South Bend, Ind.—The city is requesting bids for furnishing a 100-h.p. motor-propelled chemical engine and a motor combination hose cart and truck.

CONTEMPLATED WORK.

New Decatur, Ala.—The city is contemplating the purchase of an automobile fire engine, to cost $5,000.

Emeryville, Cal.—The city is receiving bids on a combination automobile fire engine and hose cart.

Hartford, Conn.—The purchase of fire alarm boxes, to cost $600, has been recommended.

New London, Conn.—The purchase of a motor fire engine, to cost about $6,500, has been recommended.

Washington, D. C.—Chief Wagner has recommended the purchase of a motor fire apparatus, to cost about $50,000.

Newcastle, Del.—The Goodwill Fire Co. is contemplating the purchase of a new chemical engine.

Sumter, Ga.—The city has voted to purchase an auto fire engine for the local fire department.

South Bend, Ind.—Chief Wilfried Grant has been instructed to prepare specifications for a motor-propelled chemical wagon, to cost about $6,500.

Burlington, Ia.—Chief Blank has recommended automobile fire apparatus for use in the city.

Fitchburg, Mass.—The city is contemplating the purchase of motor fire apparatus.

Malden, Mass.—The city is contemplating the installation of motor fire apparatus at all fire stations.

Taunton, Mass.—The order for a loan of $5,500 for a new automobile fire truck has passed the council.

Grand Rapids, Mich.—The city is contemplating the purchase of a motor-driven ladder truck.

Palmyra, Neb.—The town will purchase a chemical fire engine.

Rochester, N. H.—The city is contemplating the purchase of a steam fire engine and an auto combination wagon.

Asbury Park, N. J.—The purchase of an auto hose wagon for the Goodwill Co. is contemplated. Mayor Appelby has recommended the installation of new apparatus.

Dover, N. J.—The city is contemplating the purchase of motor-propelled fire apparatus.

East Orange, N. J.—New bids will be received for the installation of a fire alarm system. Fire commissioner.

Elizabeth, N. J.—Bids for a fire alarm system will be received soon.

Hightstown, N. J.—The city is contemplating the purchase of a hose wagon and chemical extinguishers.

Hoboken, N. J.—The Union Hill Taxpayers' Association has requested an automobile fire truck.

Linden, N. J.—The village is contemplating the purchase of fire equipment, to cost about $3,000.

Red Bank, N. J.—The formation of another fire company is contemplated.

South Orange, N. J.—Fire Chief Albert L. Conklin has been authorized to purchase 600 ft. of fire hose.

Herkimer, N. Y.—The village has issued bonds to the amount of $3,500 for the purchase of a combination fire apparatus.

Seneca Falls, N. Y.—The board of fire commissioners is contemplating the extension of the fire alarm system.

Asheville, N. C.—The city has voted to purchase a motor fire truck, to cost about $10,000.

Durham, N. C.—The city will erect a new fire station and purchase an automobile fire truck.

Norwalk, O.—The city is contemplating the purchase of a $10,000 auto fire engine.

Chambersburg, Pa.—The city is contemplating the purchase of motor fire apparatus.

Ellwood City, Pa.—The city is contemplating a bond issue of $15,000 for the purchase of a motor fire truck, 600 ft. of hose, etc.

North Hampton, Pa.—The installation of a fire alarm system is contemplated.

Shrewsbury, Pa.—The borough council will purchase 700 ft. of hose.

Wilkes-Barre, Pa.—The Stickney Hose Co. will purchase an automobile and combination truck.

Pawtucket, R. I.—The city is constructing a fire station, the equipment of which will be motor-propelled.

Columbia, S. C.—The city is contemplating the purchase of an automobile combination truck and chemical engine.

Coleman, Tex.—The city council has authorized the purchase of 500 ft. of fire hose.

Moundsville, W. Va.—The city is contemplating the purchase of additional fire apparatus.

Wheeling, W. Va.—The city is contemplating the purchase of an automobile fire engine.